Vol. XXIII New York—Thursday, August 25, 1910—Chicago No. 8

The Automobile

Perfect Scores May Be Numerous in the Munsey Run

BETHLEHEM, N. H., Aug. 20—With less than one-half of the scheduled distance covered, the Munsey Historic Tour of 1910 has already demonstrated everything that such a tour is supposed to show. It has so far proved a sharp test for the cars engaged; a severe trial of the drivers' skill; enjoyable alike to passengers, newspapermen, amateurs and professionals, and it has proved of some educational value, because nearly everywhere along the line where stops were made there was an insistent demand on the part of the public for information about the tour, the automobiles engaged in it and about the utility of the motor and its present status.

An immense public interest is everywhere apparent, and it is surprising to note how many persons along the route are equipped with lists of contestants and the details of the cars. Save for the city of Providence, R. I., the tourists have been treated with distinguished consideration everywhere. They were usually welcomed with open arms and seemed to be regarded as guests whose presence was desirable and profitable.

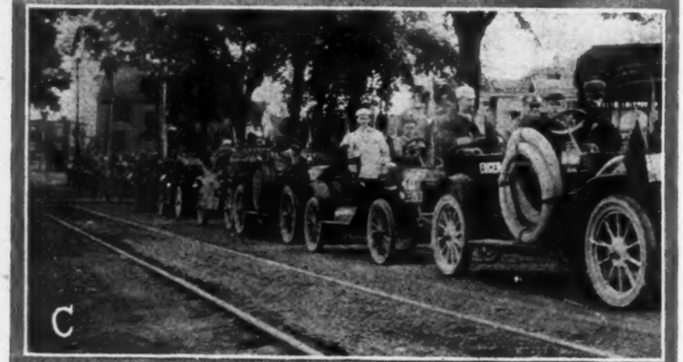
NOON CONTROL AT PROVIDENCE

As to the latter item, a careful canvass of the situation shows that the caravan leaves behind it at least $1,000 each day. Some of the estimates run as high as $1,500, but the first figure is nearer the truth. Nine cars have been penalized to date, showing that the course has been by no means easy.

Referee Ferguson's system of scoring has proved remarkably efficient and on only one day has the bulletin been delayed until as late as eight o'clock. That was at New London last Wednesday night, when it was posted about that hour.

The coming week will witness several difficult problems being presented to the cars. One

At West Point Monument



day the route is to be over 200 miles long and on another it will be over what is regarded by many persons as the worst road in the United States. How the cars will answer these questions, time only can show.

Second Day

NEW LONDON, CONN., Aug. 17—Several of the cars contesting in the Munsey Historic Tour were penalized as the result of the second day's run, which was from West Point, N. Y., to this city, a distance of 167.8 miles. For the most part the roads were good, but here and there along the route there were stretches of highway that tried the mechanism of the cars severely. This was particularly true of the course ten miles west of Willimantic, after crossing the summit of the hills.

Passing through New Britain, where the Corbin car is manufactured, the whole town turned out to welcome the representative of that factory that is competing in the tour. The Corbin, No. 11, was cheered from the time it entered town until the city limits were reached.

When the tour reached Hartford the scene was repeated with the big yellow Columbia, No. 2, in the stellar rôle.

The day's run was somewhat longer than that of yesterday and was slightly increased in mileage by reason of the fact that the roads selected for the route near New Britain were under repair and a detour had to be made. The smaller cars seemed to do exceptionally fine work during the second day and the whole caravan reported at this city within the time limit. At Waterbury, Conn., the noon control, the officials of the tour were given a warm reception by a committee of citizens and were entertained at the Hotel Elton during the brief stay. Car No. 10, Warren-Detroit, suffered four demerits for working on an adjustment of the carbureter, and car No. 21, the Ohio entry, was penalized a number of points for repairing a leak in the gasoline feed. The exact number of points involved in this penalization will be announced later.

Third Day

BOSTON, Aug. 18—The third day of the Munsey run was short in mileage, high in interest and long on discomfort. The tourists enjoyed a fine night's rest at New London and everybody was

DAILY PENALIZATIONS OF THE 28 CARS WHICH

No.	Car.	A. L. A. M. H. P.	Entrant
			CLASS 1A—CARS
13	Brush	6 2-5	Frank Briscoe
14	Brush	6 2-5	Frank Briscoe
19	K-R-I-T	21	K-R-I-T Motor Car Co.
			CLASS 2A—CARS SELLING
8	Ford	22 1-2	Chas. E. Miller & Bro.
26	Maxwell	22 1-2	Maxwell-Briscoe Motor Co.
30	Ford	22 1-2	Ford Motor Co.
34	Ford	22 1-2	Ford Motor Co. (Phil.)
			CLASS 3A—CARS SELLING
10	Warren-Detroit	25 3-5	Taylor Motor Dis. Co.
15	Regal	25 3-5	Regal Motor Co.
18	Great Western	28 9-10	G. W. Auto Co.
23	Staver-Chicago	25 3-5	Staver Carriage Co.
25	Maxwell	28 9-10	Maxwell-Briscoe Motor Co.
27	Crawford	28 9-10	Crawford Auto Co.
32	Moon	28 9-10	Moon Motor Car Co
			CLASS 4A—CARS SELLING
5	Washington	27 1-8	Carter Motor Car Co.
6	Washington	27 1-4	Carter Motor Car Co.
16	Pierce-Racine	28 9-10	Pierce Motor Co.
17	Enger	30 6-10	Enger Motor Car Co.
21	Ohio	28 9-10	Ohio Motor Car Co.
29	Inter-State	32 3-5	Inter-State Auto Co.
			CLASS 5A—CARS SELLING
2	Columbia	32 3-5	Columbia Motor Car Co.
9	Elmore	32 3-5	Frank Hardart
11	Corbin	32 3-5	Corbin Motor Vehicle Co.
22	Cino	25 3-5	Haberer & Co.
24	Stoddard-Dayton	36 1-10	L. H. Shaab
28	Glide	36 1-10	The Bartholomew Co.
31	Kline Kar	40	B. C. K. Motor Car Co.
			CLASS 6A—CARS
33	Matheson	48 3-5	Mathescn Motor Car Co.

A—Checking out of the noon control at Providence
C—On the outskirts of the city of Portsmouth
E—Where the cars were parked overnight at West Point
G—Staver-Chicago, No. 23, checking out at West Point
I—Leo Shaab and his Stoddard-Dayton, No. 24, at West Point

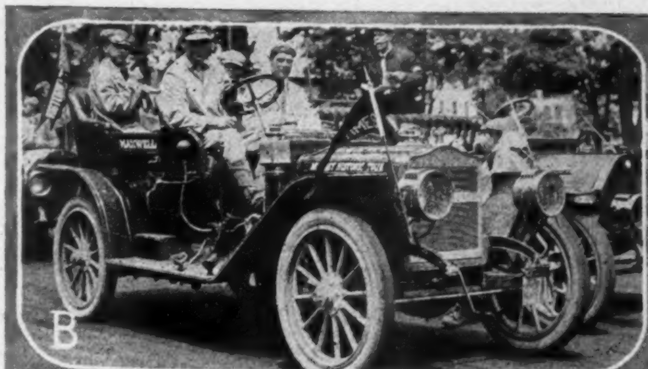
ready for an early start. Two more perfect scores were spoiled as the result of the day's run, as the Great Western, 18, was given two black marks for repairing a terminal in its ignition system and the Moon, 32, was assessed one demerit for clearing its quadrant lever of sand.

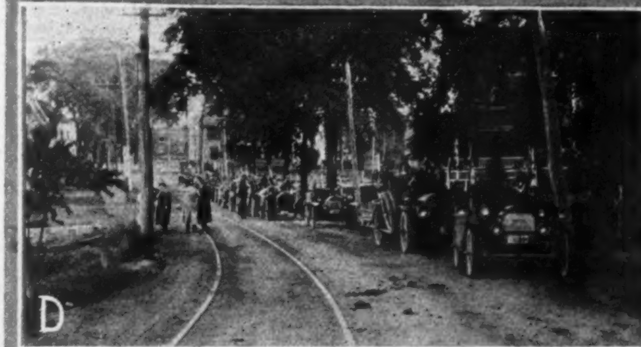
The Pierce-Racine, which traveled into New London on three cylinders, went through the day in apparently normal condition and without penalty. The Inter-State had only the high and intermediate gears in working shape, but checked in on time and without further penalty. The reverse and the low are still out of commission, but will probably be attended to to-morrow.

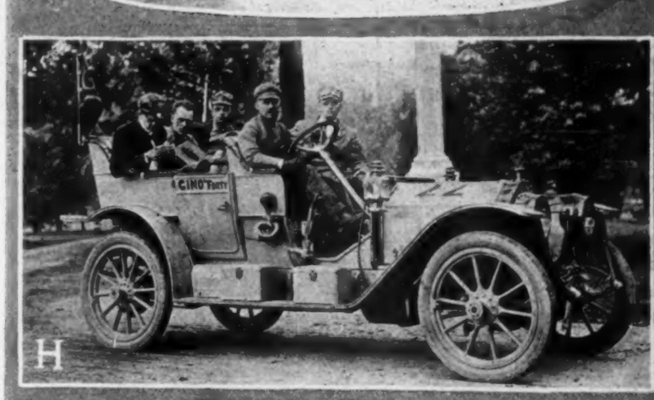
Everything was pleasant, the road, weather and the going at the start of the day's run, and not a cloud shadowed the general situation until after the cars left Narragansett Pier. Then things began to happen fast, for the E-M-F pilot car came to grief a little way beyond the pier, when in turning out to avoid a bunch of polo ponies, the car struck a tree and bent its front axle. Entering Providence, a special speed trap had been set for the tourists and the first one caught was the Brush runabout, 13; next Starter Newmyer fell into the clutches of the law and it cost $17.50 to secure his release. Then it was found that the traffic regulations of the city had been changed, apparently for the annoyance of the tourists, and the cars were not allowed to stand at the hotel named as noon control. This resulted in some confusion and when the city began to drop back from the horizon everybody breathed deeply with relief. But that was not all, for the Randolph truck, which is carrying the heavy baggage of the tour, was caught in the speed trap late in the day and was stringently dealt with.

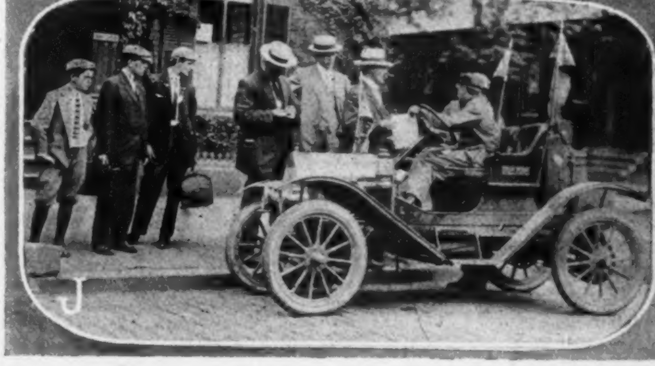
The route of the third day of the tour was from New London to Narragansett Pier to Providence and from thence to Boston, about 117 miles. The first stage of the run was over what was once an Indian trail, which legend says was constructed by the great chief Uncas, who lived during the earliest days of the white settlement. Roger Williams, the father of Rhode Island, improved the trail to a certain extent and for many years it was used as the chief means of communication between the villages

(*Continued on page 342.*)





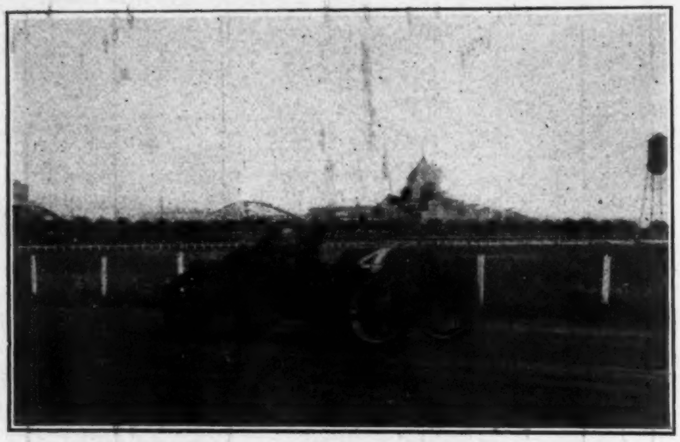




STARTED ON THE MUNSEY HISTORIC TOUR.

Driver	Penalties 1st day	2d day	3d day	4th day	5th day	6th day	7th day
SELLING UNDER $800							
E. McCoy	3	0	0	0	0	....	....
P. R. Kenny	0	0	0	0	0	....	....
K. Crittenden	0	0	0	0	0	....	....
FROM $801 TO $1,200							
C. E. Miller	0	0	0	0	0	....	....
C. F. Fleming	0	0	0	0	1000	Withdrawn	
F. K. Peabody	0	0	0	0	0	8	....
J. A. Cherry	0	0	0	0	0	....	....
FROM $1,201 TO $1,600							
Tom Berger	0	4	0	0	0	....	....
A. W. La Roche	0	0	0	0	0	....	....
C. La Mar	0	0	2	0	0	Not computed	
E. T. Knutsen	0	0	0	169	73	....	....
H. E. Walls	0	0	0	0	0	....	....
A. A. Miller	0	0	0	0	0	867	....
R. M. Upton	0	0	1	0	1	....	....
FROM $1,601 TO $2,000							
A. A. Carter	0	0	0	0	0	....	....
W. D. Arrison	0	0	0	0	0	....	....
L. Strang	0	0	0	0	0	....	....
H. Frisch	0	0	0	0	0	....	....
Ross Henwood	0	59	0	0	0	....	....
I. W. Dill	49	0	0	62	0	....	....
FROM $2,001 TO $3,000							
G. M. Wagner	0	0	0	0	0	....	....
A. S. Hardart	0	0	0	0	6	Disqualified	
A. T. Bailey	0	0	0	0	0	....	....
W. Donnelly	0	0	0	0	0	....	....
Leo Shaab	0	0	0	0	0	....	....
Fred Cassel	0	0	0	0	0	....	....
C. Fairman	0	0	0	0	0	....	....
SELLING OVER $3,000							
D. A. Hall	0	0	0	0	0	....	....

B—Maxwell No. 25, Harry Walls at the wheel
D—The tour met with fine roads entering Portsmouth
F—Elmore, No. 9, last year's winner, entering Portland
H—Cino, No. 22, W. Donnelly at the wheel, at West Point
J—The little Brush was well up in front at controls



Houpt-Rockwell, No. 4, making time in the backstretch

Stearns 24-Hour King

AFTER the most marked exhibition of consistent running ever seen in this country, the Stearns car, No. 5, swept under the wire a winner in the 24-hour race at Brighton Beach last Saturday night, scoring 1,253 miles and beating the best previous American figures for the time by 57 miles. In only two hours during the long grind did the Stearns fail to cover more than 50 miles—the sixth, when 48 were scored, and the twenty-second, when 47 were checked off.

Matheson, No. 8, 1,178 miles, finished second. Houpt-Rockwell, No. 4, 964 miles, and Cole, No. 6, 905 miles, were also running when the race was finished. The Matheson came within 18 miles of equaling the previous record.

Nine cars were entered in the race, but only seven of them started, No. 1, Fiat, and No. 9, S. P. O., having been withdrawn before the start for various reasons. The cars that started were: No. 2, Allen-Kingston; No. 3, Marion; No. 4, Houpt-Rockwell; No. 5, Stearns; No. 6, Cole; No. 7, Midland and No. 8, Matheson. All the cars except the Houpt-Rockwell started promptly at the shot of the pistol, missing cylinders delaying that car for a few moments. After the first turn in front of the clubhouse the Stearns quickly went to the front, increasing its lead over the Matheson and Allen-Kingston to two miles during the first hour. The Stearns made 57 miles during this time, breaking the former record of 56 miles made last year by the Buick and the Fiat.

Shortly afterward the two leading cars were laid up for tire trouble, and for about three minutes were compelled to go to their respective camps. There damages were quickly repaired. The Matheson contingent, proving speedier at this work than the Stearns crew, cut the latter's lead down to one mile. About the same time the Houpt-Rockwell developed ignition trouble and on one occasion the flames burst out at the left side of the car, which soon after retired for repairs. However, it was back on the track shortly after.

As the Stearns passed the 89-mile mark it met with a tire mishap, which let the Matheson into the lead, which, however,

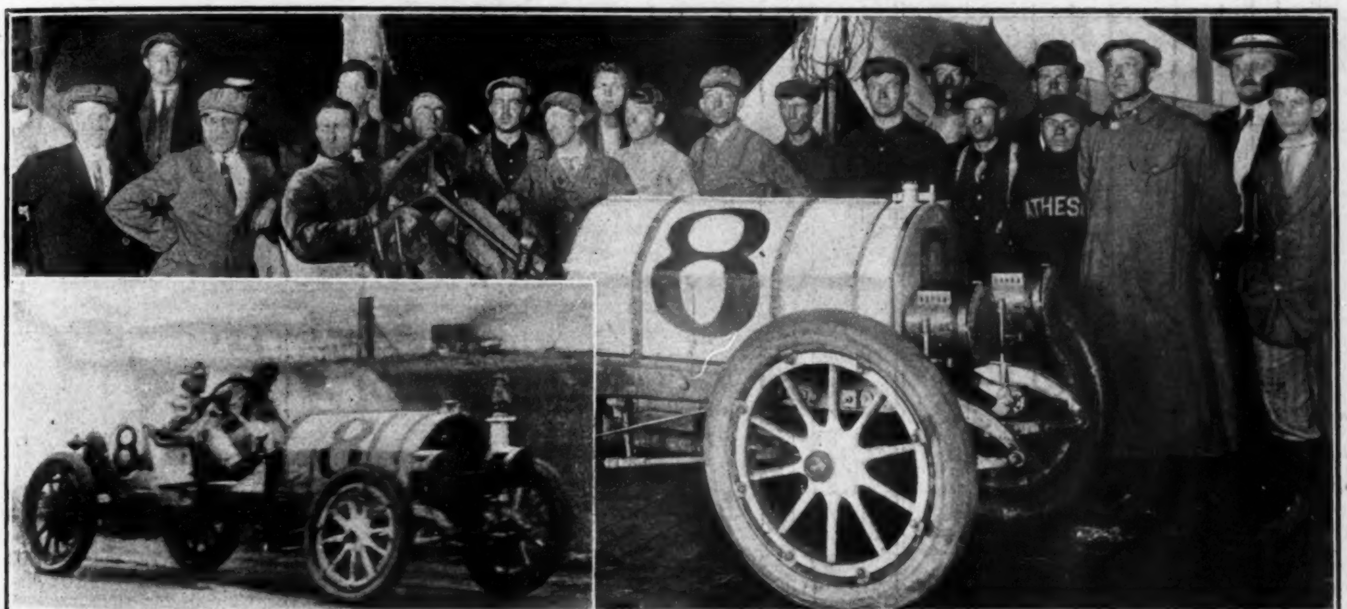
The winning Stearns contingent after the race—Fifty miles ahead and going fast

SCORE OF THE 24-HOUR RACE AT BRIGHTON BEACH, SHOWING TOTAL DISTANCES AND MILES PER HOUR

No. Car	1st	2d	3d	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	16th	17th	18th	19th	20th	21st	22d	23d	24th	Total
5—Stearns........	57	107	157	211	262	310	361	414	467	520	575	626	679	733	785	838	889	941	993	1048	1101	1148	1200	1253	1253
	57	50	50	54	51	48	51	53	53	53	55	51	53	54	52	53	51	52	52	55	53	47	52	53	
8—Matheson......	52	104	133	183	236	284	333	387	439	487	540	590	637	688	737	781	830	879	924	979	1028	1078	1124	1178	1178
	52	52	29	50	53	48	49	54	52	48	53	50	47	51	49	44	49	49	45	55	49	50	46	54	
4—Houpt-Rockw'l	45	92	141	188	236	294	294	294	294	347	383	436	486	535	583	626	669	720	768	817	870	917	919	964	964
	45	47	49	47	48	58	0	0	0	53	36	53	50	49	48	43	43	51	48	49	51	47	2	45	
6—Cole............	49	99	144	194	243	271	286	336	389	439	491	540	587	638	670	670	694	694	717	743	788	821	863	905	905
	49	50	45	50	49	28	15	50	53	50	52	49	47	51	32	0	24	0	23	26	45	33	42	42	
7—Midland.......	48	97	143	164	164	164	164	205	255	291	323	372	415	455	455	501	541	590	635	655	Snapped crankshaft				655
	48	49	46	21	0	0	0	41	50	36	32	49	43	40	0	46	40	49	45	20	..	..	..	..	
3—Marion........	46	94	138	184	225	273	323	376	416	425	Went through fence and broke wheels								..	..	..	..	..	..	425
	46	48	44	46	41	48	50	53	40	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
2—Allen-Kingston	47	93	142	193	232	Bent front axle, broke steering wheel and gasoline tank												..	..	..	..	..	..	..	232
	47	46	49	51	39	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	

BEATS THE BEST PREVIOUS "TWICE-AROUND-THE-CLOCK" TRACK FIGURES AT BRIGHTON BEACH BY 57 MILES. MATHESON FINISHES SECOND

it did not hold for a long time, for after starting on its 104th round its right rear tire exploded and the car skidded into the fence. Owing to its terrific pace it did not come to a standstill before it had gone through the fence for a second time, thereby damaging its left front wheel and steering cross rod. Neither of the two men in the car was injured, but the machine had to stay in the camp for half an hour, which changed the position of the car from first to sixth.

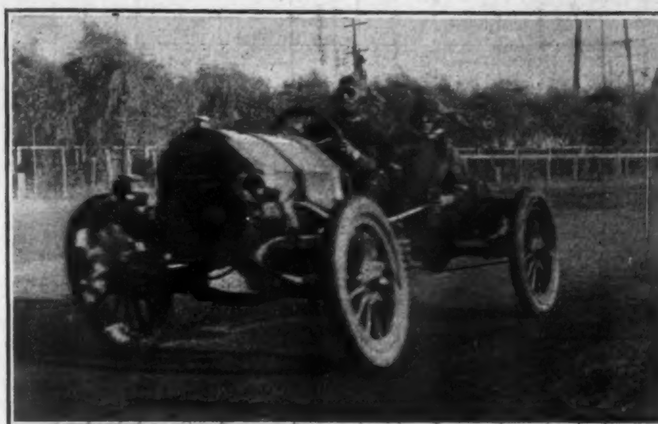


The Matheson outfit, which made a plucky fight—Trying to close up the gap

After this the Stearns again went to the front and at the end of the fifth hour it had made 262 miles, being followed by the Cole (243 miles), while both Matheson and Houpt-Rockwell had run 236 miles. During the next hour the latter overtook its rival and at the end of the hour led it by 10 miles. It was during this hour that the first serious mishap occurred, which caused the withdrawal of a car. The Allen-Kingston, with Cobe at the wheel, went through the fence, bending its front axle and breaking its steering wheel and gasoline tank. The driver's face and side were badly cut. An hour before, the Midland had its timing gear damaged and as it also developed valve trouble it had to be taken to the camp for some three hours.

About 3 a. m. the Houpt-Rockwell broke its universal joint, which took three hours to repair. This car, by the way, changed tires very frequently, and by the end of the eighteenth hour had used 40 of them. Hardly an hour after No. 4 had re-entered the race another car, Marion No. 3, went through the fence and damaged its wheels to such an extent that it had to retire permanently. Wally Owen, who was at the wheel, suffered severe cuts to his face and eye.

After this the remaining cars continued, the machines going into camp periodically only to take on gasoline or to adjust or change tires. Regarding the latter point the Midland performed especially well, and during more than three-fourths of the time experienced absolutely no tire trouble. In the twentieth hour, however, it met its fate. Owing to the engine being overheated, the car was retired. At the end of the twenty-second hour



Cole, No. 6, was still going at the close of the race

Houpt-Rockwell went through the fence, breaking a knuckle in the steering gear. Nobody was hurt, but the car was laid up for almost an hour. The other four cars finished the race in this order: Stearns, Matheson, Houpt-Rockwell, Cole.

Al Poole drove the Stearns at the finish of the race, while Charles Basle was at the wheel of the Matheson. The first prize, amounting to $1,500, went to Stearns; the second, $600, to Matheson, while each of the two other cars which finished were rewarded with a prize of $200. The winning Stearns is privately owned by J. M. Rutherford, of New York City, and had been run 40,000 miles before starting in the race. The Stearns engine develops 60 horsepower, that of the Matheson 50, and those of the Houpt-Rockwell and Cole 40 and 30 respectively.

Wants Roads to Serve New York Towns

SYRACUSE, N. Y., Aug. 15.—D. M. Power, of the Maxwell-Briscoe Syracuse Company, calls the attention of the State Engineering Department to a matter of novel interest in the present laying out of State roads. He says of late years the geographical surveys provide only for the obviation of engineering difficulties, the maintaining of a regular grade, etc., to the exclusion of the convenience of communities.

Many such State roads are being built to skip cities of considerable size by as much as three miles. State roads built really to serve the communities, says Mr. Power, would benefit equally tradespeople and tourists.

Industrial Aeroplanes

BY MARIUS C. KRARUP. CONTINUED FROM LAST WEEK. DETAILS RELATING TO EQUILIBRIUM, WEIGHT, SKIDS AND A NEW PRINCIPLE IN PROPELLER CONSTRUCTION

IN the article appearing last week under this title there was illustrated and described in part a type of aeroplane construction in which the requirements for safe equilibrium are met by a number of provisions all designed to work together for the same purpose and therefore forming a suitable basis for a close study of these requirements. To refresh the memory of readers, front and side view diagrams are shown herewith in Figs. 6 A and B representing the monoplane variety of the construction, and the wings are shown in a somewhat extreme adjustment, such as might be required exceptionally in very bad weather in a moment of danger. The wing *L* is turned to a high tilt with its axle in its normal horizontal position, while the wing *K* is tipped around its pivotal suspension at P_1 and at the same time has been turned around its axle, so that the front edge is much lower than its flexible rear edge. The propeller and the skids are not shown. The axles of the wings are designed as consisting each of three spars or tubes spaced triangularly apart with the hypothenuse of the triangle forming part of the wing, while the catheti and the third spar form the necessary reinforcement and extend below the wing. But in the sketches, Figs. 6 A and B, these axles are shown as single spars, X_1 and X_2. The control elements by means of which the wings may be made to assume their whole range of positions jointly or separately are shown with more detail in Figs. 7 A and B, and in Fig. 8, while Fig. 7 C represents details of the skid construction whose practical value, by the way, depends largely upon two other factors in the design, as explained later.

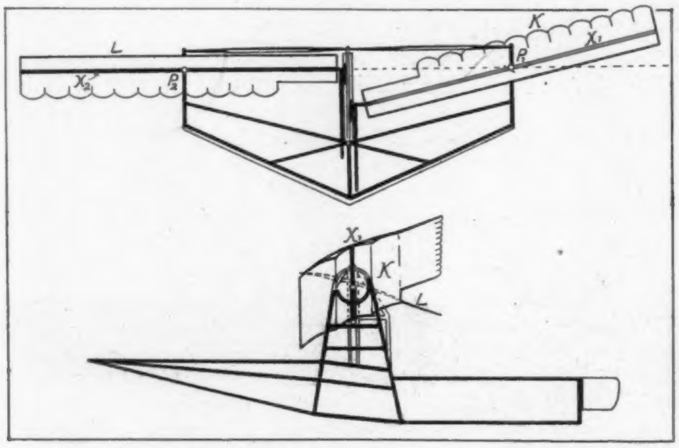


Fig. 6—Front and side view diagrams of monoplane, showing extreme adjustment of planes

The reasons why the design complies with the requirements for enabling an aviator to preserve the equilibrium of the machine under all contingencies may first be recapitulated, though they have been stated at some length in a number of previous articles. And at the same time it may be pointed out, in so far as possible, how and why the construction may be materialized without exceeding the weight limit, and why a construction of this nature seems adapted for industrial development through those methods of manufacture to which the automobile owes its rapid evolution.

As is now becoming more generally recognized, control by rudders depends for safety upon the speed and direction of the machine and is rendered ineffectual when the motor stops and the wind at the same time prevents the machine from assuming the poise for gliding. If the propulsion (not to be confounded with the motor) is weak, the wind alone may interfere with the rudder action. By employing immobile keel planes, either horizontal or vertical, flight in fair weather is steadied, but new dangers are added in irregular weather, when the wind may act more strongly upon the immobile planes than the latter can act upon the air by virtue of the speed of the machine. The whole recent French development, involving increased areas for the immobile surfaces or "empennage" and increased motor power, may therefore be considered as a gambling game in which safety is staked upon the reliability of the motor in conjunction with such fair weather as may be chosen for exhibitions and the winning of prizes. Most of the machines become unsafe when the motor stops working; all of them when both conditions for safety fail. The aeroplane, to become an industrial product, must be on a safer basis. In addition to these reasons for abandoning rudders and "stability planes" and adopting instead a suitable adjustability of the main planes (which in the absence of a positive fulcrum for any control effort means the mutual adjustability of the main planes to the body of the machine and of the body of the machine to the main planes), there may be mentioned the weight and incumbrance of the scaffoldings required for maintaining the rudders and keel planes in their positions far in front or to the rear of the main portions of the machine, as well as the considerable air resistance caused by these scaffoldings.

Some of the difficulties in aeroplane design, and especially those commonly overlooked, may be traced to the fact that the requirements for preserving equilibrium are more severe in the human-made flying machine than in the bird, since the bird can rely absolutely upon its motor power and is of such small dimensions that the chances of a gust of wind attacking one side of its structure, and not the other, are exceedingly remote. But with these more severe requirements the human designer nevertheless has to reckon. The birds, moreover, do not rely on rudders or keel planes, using their tail for a tilt rudder only for hovering and alighting. Their main reliance is in their adjustable wings which are their main planes and propellers, combined.

The construction submitted for study in these articles has not been designed, however, from the bird's or any other living creature's structure as a basis, but from experiments and theories whose adaptation to existing machines dictated one modification after another. The resemblance to a bird which the construction shows in its monoplane variety is purely incidental.

It will be noticed that side steering may be effected independently of the oblique rear rudders. It may be accomplished by tipping the inner wing upward, diminishing its carrying capacity, and at the same time turning it to a higher tilt and increasing the resistance to propulsion on that side. During slow flights with high tilt it may also be accomplished by simply giving the inner wing a quick turn to a tilt above 15 degrees, where the resistance to propulsion increases more rapidly than the lift. For small turns, rises and drops in fair weather one or both of the oblique rudders alone may be turned, the planes always being in reserve to help out the rudder action if necessary.

The advantages of adjustable main planes appear to many so self-evident, in comparison with rudders, that a number of patent applications for this type of design are said to have been filed recently by well-known inventors and engineers, and the tardiness of aeroplane builders in adopting this feature may be ascribed to the difficulties in combining it with sufficient strength and lightness. These difficulties are very real, in comparison

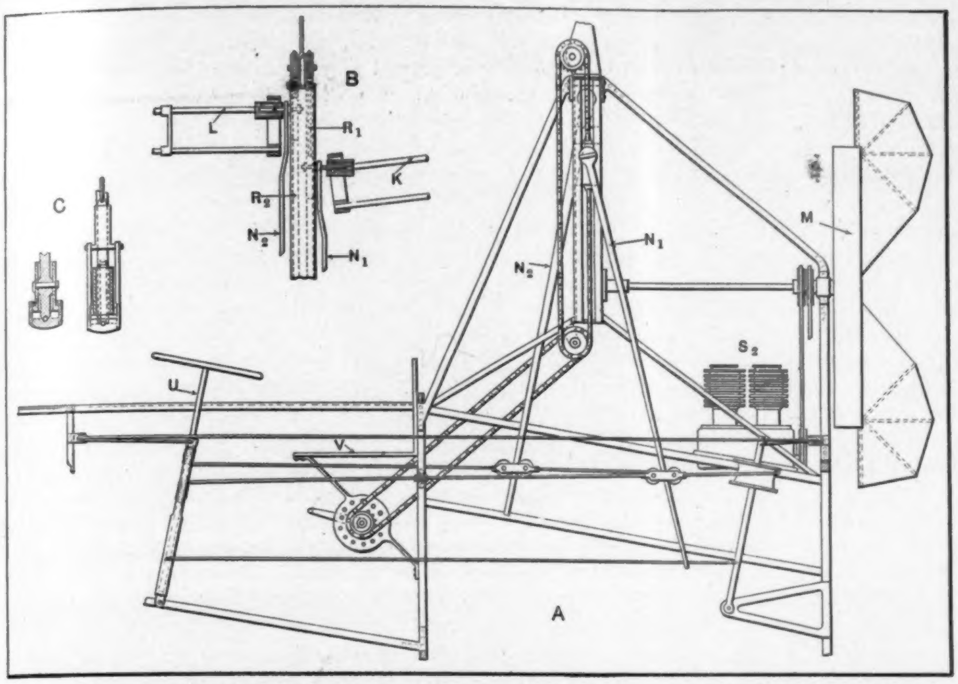


Fig. 7—A, Control elements and propeller; B, Detail view of central slide mechanism; C, Section of double skids and front view of catch for locking and releasing them

with the fascinating ease with which an ordinary biplane may be built from flimsy spars and piano wire stays, but on the other hand all the material which is saved by dispensing with rudder and tail supports may be applied to provide firm support for the points around which the main planes are made adjustable. The stays supporting the pivotal rings, P_1 and P_2, Fig. 6, illustrate the comparison, and the prow and tail in this construction may be of exceedingly light weight, since they taper forwardly and rearwardly and, being covered, are more than self-supporting. Their form, as referred to last week, instead of causing danger by catching the wind obviates the loss of equilibrium by certain self-righting properties. These factors all contribute to sustentation, equilibrium and lightness. In addition, the construction of the planes, with curvatures placed "in series," as also explained last week, is calculated to serve strength, lightness and equilibrium by increasing the carrying capacity per square foot for any given tilt and thereby rendering it possible to reduce the dimensions and wind-catching surfaces throughout the machine for any given weight it has to carry. By choosing the pivots of the wings near their middle, the stresses are minimized and balanced, and the efforts required for control movements are reduced, particularly as compared with any construction by which it might be attempted to imitate bird construction and having the pivots of the wings near the center of the whole machine and at the inner end of each wing, as the bird has it at its shoulder joint.

Not only the apparent difficulties in securing lightness and strength to meet the more concentrated stresses to which a machine with adjustable wings is exposed have militated against the early adoption of this design feature, but also a reasonable advance consideration of the increased air resistance which might be expected in a machine made heavy enough in its parts for supporting this equipment. If the trussed body in the construction shown were uncovered the air resistance against it would be so considerable as to make the design impracticable, but the specific design of prow and tail which goes with it is calculated to not only remove the objection related to air resistance, but to transform this resistance into additional carrying capacity and a means for several other purposes of value. By forming the prow and tail in conjunction with the body proper, as they are shown, the normal resistance to forward movement is figured to be about equal to the resistance against the main planes at all flying tilts and this permits the propeller to be placed midway between the main planes and the body and to have the center of gravity lower with relation to possible disturbances of the balance, or rather the forces brought to bear in such disturbances, than in either biplanes or monoplanes of existing types. That this result is produced may not be apparent at once in comparison with a biplane. The lower plane of a biplane, however, is highly susceptible to disturbing influences, while the under surfaces of prow, body and tail are self-righting against lateral disturbances, which evidently means that the low center of gravity gets an additional chance to correct any disturbance of the main planes; that is, the center of gravity is lower with relation to the disturbing forces. It is further noticed that the shapes of prow, body and tail are self-righting against a backward tumble, so long as propulsion takes place, because any backward tipping brings the under surface of the tail into action as a sustaining surface, while the prow, being placed normally at a tilt which gives nearly maximum sustentation, under these circumstances gives little more sustentation than before. As against a forward dip, the shapes of prow, body and tail are not self-righting, either during propulsion or when the motor is stalled, and with regard to weight distribution the machine is therefore supposed to be so balanced that the forward end will dip, and it remains for the aviator to regulate this tendency by the proper adjustment of the main planes, whether the machine is propelled or gliding. But the natural tendency to dip forwardly corrects that most dangerous possibility of a backward tumble, when the motor is stalled and the all-saving speed for some reason has been reduced, against which no mere shape can prevail, it being amply proven that pure vertical parachute action presupposes much larger areas for the weight carried than can come into consideration for an aeroplane machine.

It is now believed to have been shown that the construction

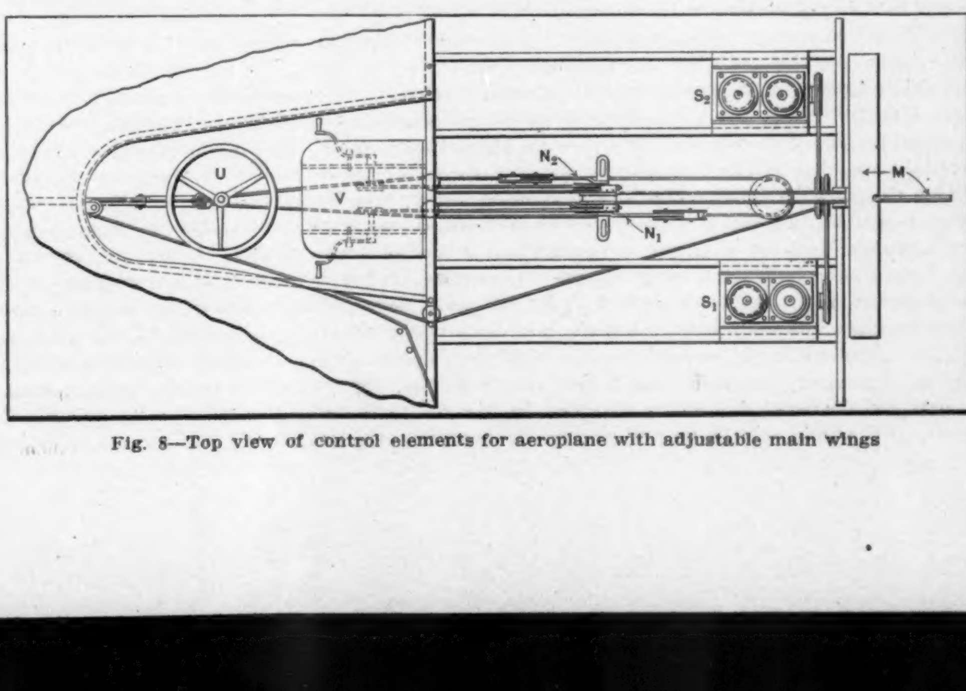


Fig. 8—Top view of control elements for aeroplane with adjustable main wings

illustrates many of the requirements in aeroplanes in general by bringing strongly to mind all the factors and forces involved in the operation of a flight machine and suggesting many ways in which the relations between these forces may be changed by variations in construction. It remains largely a question of engineering judgment and of resourcefulness in the use of available materials to determine the means for reducing the construction, or any similar construction, to its lowest weight limits. Materials and their use form too large a subject to be included in this description, and the writer must limit himself to the statement that he estimates the weight, with one man of 200 pounds and all supplies, including 100 pounds of gasoline or kerosene, at about 1,150 pounds for a machine whose main planes span 28 feet. But by such steel construction as may become practicable by the co-operation of the alloy steel mills or, at much greater cost, by elaborate hand and machine work in such material, it should be possible to reduce the weight to 800 pounds or less with some incidental gains in the reduction of air resistance.

Two extraordinary advantages in a construction deriving its control from adjustable main planes relate to speed variations and to the possibilities for producing very large airships of great carrying capacity. The suitability of the construction for the highest as well as the lowest speeds follows simply from the adjustable relations between the load and the planes, which permit the machine to find its balance in the atmosphere at the tilt which gives the highest resistance against propulsion as well as at the tilt which gives the smallest resistance and therefore the highest speed, without any necessity existing for correcting the balance by a retarding rudder action. The possibility of building large structures follows from the easy adaptation of the design to tandem arrangement. The irregularities in sustentation which have interfered with all previous arrangements of tandem planes naturally fall away when the regulation of the course is accomplished by the mobility of the planes themselves rather than by the operation of rudders, at the front or rear, whose task is so much harder as the extension of the planes fore and aft, collectively, is greater. The possibilities in this respect seem sufficiently attractive to enlist the interests even of those who believe in the development of control by rudder for aeroplane machines of small capacity.

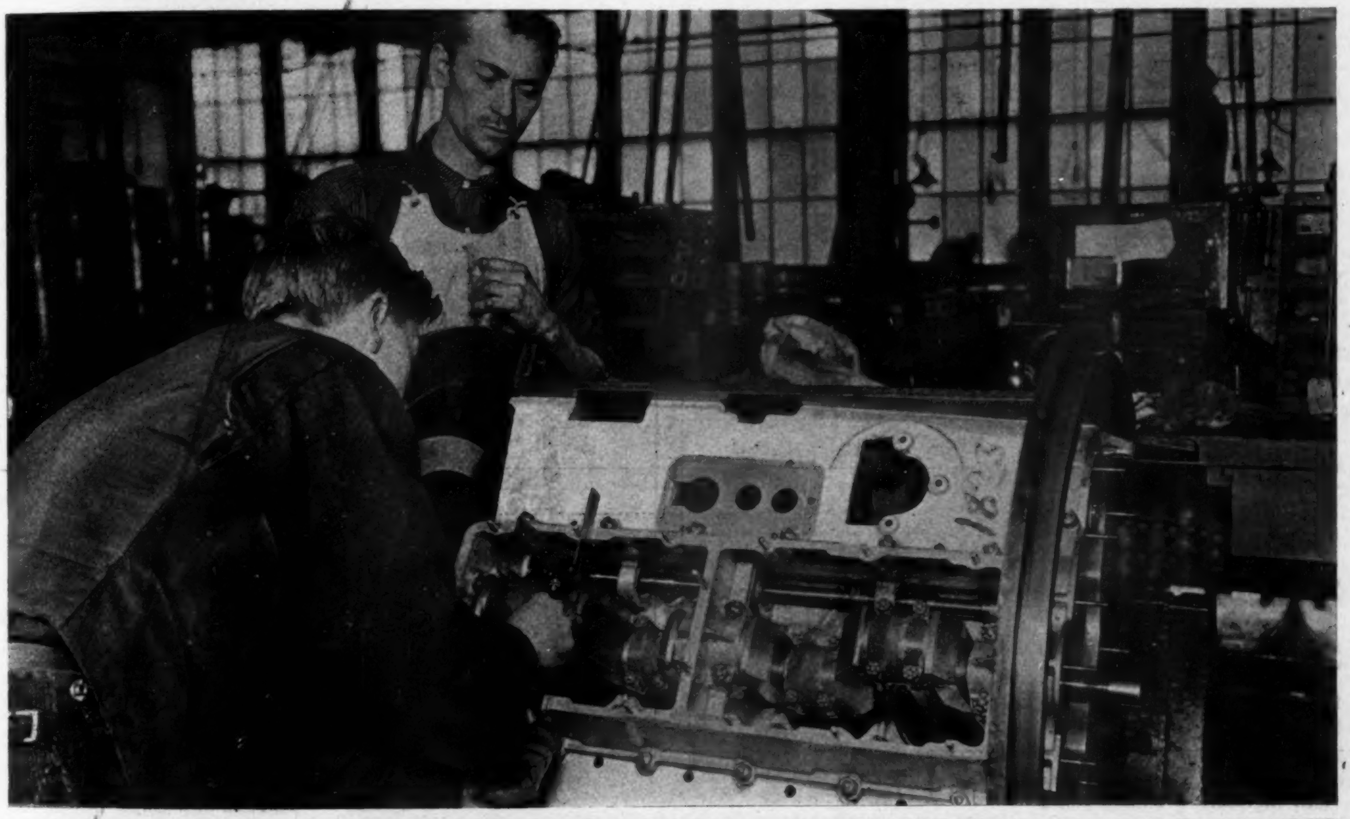
In Figs. 7 A and B and in Fig. 8 certain definite mechanical expedients for effecting the desired control of the main planes are illustrated with sufficient detail to be self-explanatory, in connection with the brief description given last week. As presented they merely show that the control is within the range of practical mechanics.

Mention of the propeller design and of the skids has been reserved for the last because these features represent ideas whose organic connection with an aeroplane construction designed with a view to industrial development and the safeguarding of equilibrium is less close than that of the features already described, and because the practicability of skids designed to launch an aeroplane in the air with a run not exceeding 6 to 8 feet depends greatly upon obtaining a much stronger propulsion from the propeller than has ever so far been obtained in aviation practice and also somewhat upon the efficacy of the special construction of planes, with curvature "in series," which was described in the first instalment of this article. Without the reduced air resistance for a given lift which these planes should produce and the increased propulsion for a given motor power which the propeller construction should produce, the chances for imparting a starting speed of twenty miles per hour, or more, to an aeroplane machine weighing more than half a ton, by a run of only a few feet, seem anything but encouraging, but it is nevertheless means for accomplishing this result under favorable circumstances which are indicated in the skid construction shown in Fig. 2, last week, and in Fig. 7 C. It is assumed that by providing the upper runner of the double skid with anti-friction rollers and the lower one with a wire rail, for the rollers to run upon, and a releasable catch by which the machine and the upper skid-member may be held back until the propeller operates at its full power, the retarding as well as the jolting effect of more or less uneven ground may be so far reduced that a machine with a maximum of propulsion and sustentation and a minimum of resistance may gain the necessary speed on the short run. As shown in the sectional view, Fig. 7 C, the machine is of course intended to carry the whole skid device in flight by means of the flanges on the lower member.

The propeller is combined with a flywheel of thin, rigid material serving the purpose, aside from the flywheel functions, of maintaining the front edges of the two propeller blades rigid while the rest of the blades are turned from their rest positions, which may be in a plane laid through the shaft, to a pitch determined by the speed of rotation and their resilient resistance against deflection. The blades, in other words, are turned to pitch by the air resistance which they encounter. Their efficiency as propellers is poor for any speed of rotation which falls much below that which produces suitable pitch but rises rapidly as this pitch is approached. The pitch is modified by external circumstances, such as sudden gusts of wind or eddies or high forward speed, the blades responding automatically to all forces increasing or lessening the pressures. Probably the most suitable pitch may be found higher for resilient than for rigid blades. The propeller blades are indicated in Fig. 7 A and in Fig. 8 as being perfectly flat, but in reality they should be formed with a pressure surface slightly hollow transversely, and in addition with shallow air pockets corresponding in nature and purpose with the sub-curvatures employed for the under surfaces of the main planes of the machine. The resilient resistance against the deflection of the blades is provided partly by making the material of the blades, except the entire front edge, resilient, as by securing skin or rawhide to flexible steel fingers, but mostly by attaching an adjustable, multiple helical spring to the flywheel rim, near each blade, and compelling the blades to stretch the springs when turning to pitch. By cutting out a niche in the inner wooden felloe of the flywheel rim, the springs may be placed so as to cause neither air resistance or sound in objectionable degree. To serve as a base for the spring action is the third function of the flywheel and a useful one in practice, as it would require endless experimentation to build resiliency directly into a propeller blade and have it commensurate with a given motor power minimum, with the degree of accuracy necessary for accomplishing much better results than may be obtained with a propeller of the customary almost rigid type, when the latter is provided with improved curved pressure surfaces. In theory, however, the relations between the rigid and the resilient propeller are fairly clear. Assuming that two propellers are alike in all features, excepting that one is rigid and the other capable of turning around its rigid front edge, as described, against an adjustable resistance, it is readily seen that the motor must do more work to turn the resilient propeller at a given speed than for turning the rigid one. If the speed is insufficient to create a resistance which will turn the resilient propeller's blades to the same pitch as that of the rigid blades, the requirement for greater power follows from the higher pitch alone, since it is contradictory to assume that high pitch, with equality in all other things, can be driven as fast as low pitch with the same power. Further, as the resistance to rotation must at all times be at least equal to the resilient resistance against the deflection of the blades (plus friction), since it is this resistance to rotation which alone causes the deflection, it becomes mathematically certain, by comparing these two impregnable inferences, that the motor power in the case of the resilient propeller must do both the rotating and the deflecting, while in the case of the rigid propeller it does the rotating only. If then the resistance against deflection of the resilient blades is arranged to be equal to their resistance against rotation at the pitch of the rigid propeller, it will require twice as much motor power to rotate the resilient propeller at the speed which will produce this pitch as for rotating the rigid propeller at the same speed.

(*Continued on page* 338.)

Proper Assembling Represents Half the Quality



ERECTING MOTORS AT THE PACKARD PLANT, ILLUSTRATING THE USE OF SPECIALLY CONTRIVED STANDS

ADVERTISING a fallacy does not make it a truth, but it does induce a large number of people to believe that the statement is founded on fact. It has been advertised year after year, and in a thousand ways, that carbon formations in the combustion chambers of a motor's cylinders come from using too much poor lubricating oil. The distillers of lubricating oil may or may not have believed the story; at all events, all they have ever done about it was to recommend the use of the finest grades of lubricating oil, which is the proper course in any event, but in the meantime carbon trouble in motors has gone on uninterruptedly quite independent of the lubricating oil employed, for the very good reason that the major portion of the carbon which is at the bottom of all complaint comes from the use of an excess of gasoline or the right amount of gasoline in the absence of a sufficient volume of air to supply the requisite quantity of oxygen with which to set fire to the fuel and burn it to finality.

In many of the plants at the present time experiments are going on with a view to determining the real cause for carbon formations, and from what has been learned already it is a moral certainty that the growth of carbon as it is caused by lubricating oil is infinitesimal as compared with the carbon accumulations from other sources, as poor carburetion, improperly provided compression and ignition systems of no great competence.

It would seem that carbon is likely to form in motor cylinders if the compression is very high. When the compression ranges around 75 pounds per square inch absolute, the accumulation of carbon that may be traced to compression is negligible.

If a good ignition system is employed and it is maintained in

proper working order, combustion is far more complete and the carbon trouble is much deferred. The reason why ignition may be at the bottom of trouble of this sort is explained as follows: If the ignition does not take place at the proper time the chances are that a portion of the fuel will be burned to incomplete combustion, the terminal pressure will fall below the desired point and conditions of inferior scavenging will set in.

The greater part of carbon trouble, however, must be charged to inferior carburetion, and that this source of trouble is becoming more acute every day is recognized, due to the fact that the non-volatile constituent in the gasoline supply is being increased from time to time at the cost of the more volatile hexane which is being decreased in the same ratio.

If it will be remembered that fully 50 per cent. of all the volatile portion of crude oil belongs in the distillates approaching decane, it will readily be appreciated that the distillers of oil are extremely anxious to have decane liberally represented in automobile gasoline. It is not believed that they consult the builders of carbureters in matters of this sort, nor is there any record of their having called a convention of autoists with a view to being favored with its opinion as to the efficacy of kerosene oil for use in automobiles.

Surprising as it may seem, the inventors of kerosene motors have been put out of business due to the improvements wrought in carbureters and the splendid backing of the distillers of crude oil. Just as fast as carbureters are improved so that they are rendered more capable, the distillers of crude oil add another dash of the less volatile constituents until finally the carburetion problem has arrived at a near approach to the time when automobile gasoline may contain 50 per cent. of kerosene oil.

Since this is the exact amount of kerosene oil present in the whole content, there is no inclination on the part of the distillers of oil to add more—it would even be a detriment to do so.

The thermal value of automobile gasoline as it now obtains is slightly better than that of true gasoline. This is a fortunate circumstance, and it means that more power will be delivered from a motor that is capable of burning automobile gasoline than can be taken from a motor that is fed on true gasoline, the difference being sufficient to be well worth taking into account.

But it is to the detriment of good operation to try to burn the automobile gasoline of to-day, using a carbureter that may have worked extremely well in the days of hexane.

Unless carbureters are so designed that they will vaporize automobile gasoline, it will, of course, pass into the combustion chamber in liquid form, where it will "crack," precipitating carbon, forming a hard crust, which interferes with the proper thermal action of the motor. Cylinder oil plays a small part in this malperformance, since it serves as a binder for the precipitated carbon, to which must be added silicon and other silt formations, which are sucked in through the orifice of the carbureter, and carried into the combustion chamber.

Some of the experiments that were conducted seemed to show quite conclusively that silicon alone does not form a crust in the combustion chamber, so that if the gasoline can be prevented from cracking, there is almost no danger of carbon trouble or the formation of a sufficient crust to produce noticeable trouble.

This is but one of the several important fields that are receiving the attention of the capable engineers whose life work lies in the building up of the automobile. Unfortunately, there is so much to be done, and there are so many questionable traditions to be lived down, that progress, however substantial it may be, takes on pigmy proportions as measured by the wants of the industry. Just how long it will be before this many-angled situation is reduced to a satisfactory working level is hard to predict, but it does seem as if the advertising of fallacies should be confined to "paid for" space, if it is to be tolerated at all, although it is difficult to understand why such an undertaking would be worth paying for. In any case, it is believed that the greatest offenders are among the class of information dispensers who cater to the editorial pages of the technical press, many of them dealing in synthetic matter rather than relating proven facts.

Automatic Tire Pumps

SHOWING A TYPE OF AUTOMATIC TIRE PUMP WHICH IS WORKED BY SUCTION AND COMPRESSION FROM THE MOTOR CYLINDER WITH AN AIR PUMP IN TANDEM RELATION

According to the best advices obtainable from makers of tires, supplemented by the practices among taxicab operating companies, the life of pneumatic tires is shortened more if they are run when deflated than from any other cause. It is claimed by experts that a tire is too small for its work unless it will maintain a substantially round shape at the point of ground contact when it is supporting the total load. With a view to obtaining the greatest possible tire life, the first requisite under the circumstances is to employ tires that are sufficiently large to sustain under the load without inducing flexure.

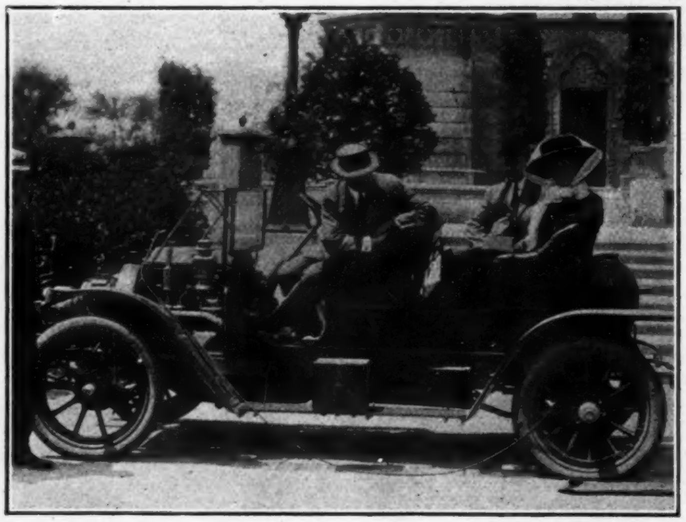


Fig. 1—Depicting the pump in place on a car and the pressure tubing leading back to the left rear tire, which is being inflated

It is a well-understood fact in connection with steel and other materials that they will deteriorate rapidly if they are subjected to flexure, and the only material obtainable that seems to last for a commercial length of time under conditions of flexure is spring steel. Even this product gives out much too soon, and every autoist of experience realizes that the chances of breaking the springs upon which the body rides are very great indeed. Moreover, statistics conclusively show that next to tire trouble springs play a second part from the point of view of failure in service.

Flexure and shock are at the bottom of spring breakages, but it must be remembered that tires take the initial shock, and it is much subdued by the time it is taken up and dampened by the action of the springs. If the finest grade of spring steel is barely capable of sustaining under conditions of secondary shock together with flexure, it is scarcely to be expected that tires will satisfactorily support initial shock and stand the hardship of flexure besides.

It is impossible to get around the initial shock condition. Tires are used on wheels for the purpose of taking it, but

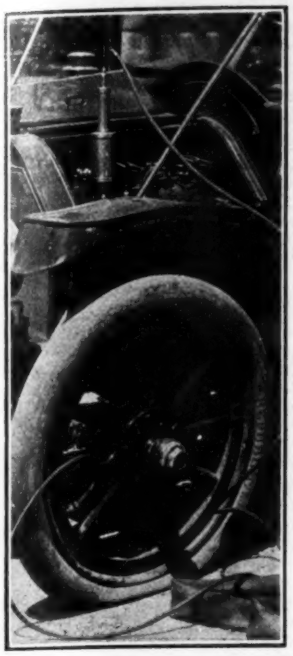


Fig. 2—The pump in place on the motor and the pressure tube leading to the left front tire

it is possible to avoid subjecting them to flexure as well, provided of course the tires are of sufficiently large section in the first place, and if they are sufficiently inflated besides.

The average autoist seems to think that tires will not stand a high pressure. On the other hand, one expert whose ability is recognized in the tire world has carried the inflation problem so far that he used a pressure of 500 pounds per square inch in bicycle tires without endangering the fabric on account of the high internal pressure. If a bicycle tire will withstand this high pressure, there can be no possible chance of inflating automobile tires by any ordinary means to a pressure sufficiently high to endanger the fabric through high fiber strain from this cause.

The one thing that an autoist can do that will reduce the cost of tire maintenance to the lowest possible limit is to maintain the condition of inflation so that the tire where it contacts with the ground will remain very nearly in the same state of roundness as it will be at any other point in its section. That there will be a slight flattening is unavoidably true, but in no case should this flattening be more than that which will reduce the radial diameter of the tire by 1-5 of an inch.

It is now the practice among some of the makers of automobiles to supply power pumps, gearing them from the motor at some convenient point, and so arranging that the autoist will have no excuse for running on partially inflated tires. There are a vast number of automobiles in service, however, that are not provided with power pumps for this purpose, and the Skinner & Skinner Company, realizing the importance and scope of this field, is marketing a power tire pump that may be attached to any automobile, involving no greater undertaking than the removal of a spark plug and the screwing into place of the power pump. These pumps are manufactured by the company, at 1716 Michigan avenue, Chicago, Ill., and they are so put out that they will fit into place without trouble if the autoist desiring one is careful to state the make and model of his particular car.

Fig. 1 shows the power pump in place on an automobile, and the pressure tube leading therefrom to the valve of the tire on the left rear wheel. The motor is turned over slowly, running on three cylinders while this work is being done, and under ordinary conditions the tires are pumped up to about 90 pounds per square inch. Fig. 2 shows the tire pump reaching out above the bonnet, and affords an excellent idea of its size relative to the dimensions of the motor and relating parts. Fig. 3, however, presents the tire pump with the motor almost cut away, showing the thread of the pump, T1, screwing into the spark plug opening, S1. The large cylinder, C2, holds a reciprocating piston, which is actuated first by the suction of the motor which pulls the piston down and, second, by the compression of the motor, which pushes the piston back again. The small cylinder C1 holds a piston in tandem with the working piston, there being a connecting rod between. When the power piston reciprocates, due to suction and compression of the motor, the small cylinder reciprocates in unison, taking air at the end of the down stroke and compressing it on the up stroke, so that it passes out through the valve V1 into the connecting hose H1, thence to the tire to be inflated. For the purpose of admitting free air to the small cylinder, a hole is provided so that when the air piston is at the end of the down stroke the hole is uncovered and the air is free to rush into the small cylinder.

The working cylinder being relatively large in area is capable of supplying the necessary force to compress the air in the small cylinder to at least 100 pounds per square inch, and the pump is so contrived that nothing but pure air can enter the air pump and find its way into the tire to be inflated. Fig. 4 is a section of the pump showing the relation of the two pistons and the connecting rod between, also the spring buffers at the top and bottom of the stroke, by means of which the reciprocating motion is arrested, and the piston set is accelerated in the reverse direction as many times as the occasion requires, without shock or other deteriorating troubles.

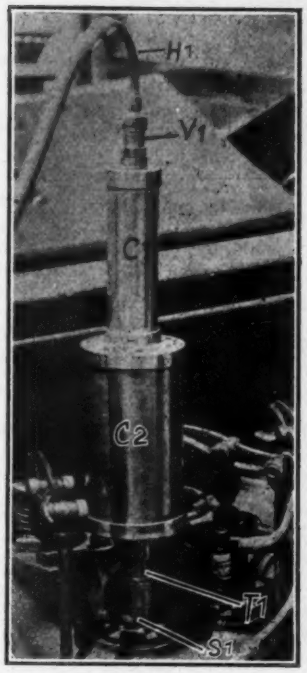


Fig. 3—The pump screwed up in place of a spark plug on the cylinder of the motor

The entire outfit is substantially made, using brass tubing, and high duty brass fittings; the joints are threaded and thereafter brazed so that leakage is avoided and the relations of the parts remain firm without showing depreciation in service. The pistons are leather packed, using a special grade of material which has long served in this class of work in other fields, and which proves to be the most efficacious in this work. The pump occupies even less space than a reasonably capable hand-pump, it being somewhat shorter and very little greater in diameter. When it is through with the work of inflating a tire, it is screwed off of the motor, and may be packed away in the tool box, where it will remain without danger of being damaged, ready to take up its burden again should the occasion require.

In applying the pump it is not necessary to use a wrench of any kind. Hand pressure in threading on the pump will bring it home with sufficient force to make it tight, and when it is to be removed the same reasoning applies. In operation, if the tires are of large section, and diameter, all that is necessary to obtain a sufficiently high pressure is to speed the motor up a little, and with this facility the autoist soon learns just how fast it is necessary to speed the motor to gain the right pressure. In service the pump runs quite silently, due to the entire absence of any mechanism that can develop lost motion, and there being no gears employed, noise cannot be expected. Connecting hose may be of any desired length and while ordinary rubber tubing is used in most cases, metallic hose is also available.

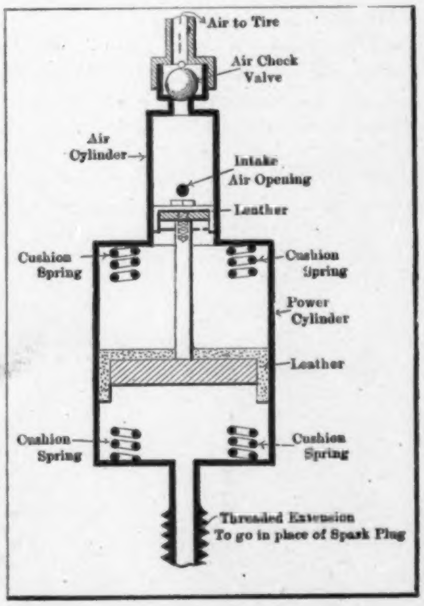


Fig. 4—Cross-section of the pump, showing the connection between the power and air pistons and the buffer springs

The Vortex Vaporizer

PRESENTING A NEW IDEA IN CARBURETER DESIGNING; FUEL IS HEATED TO OVERCOME THE LATENT HEAT OF EVAPORATION; LARGE GLOBULES ARE CAST OUT

JUST what is the composition of "automobile gasoline"? Until this question is answered to the satisfaction of the reader it will be difficult to go on with any explanation of the vaporizer under discussion. The whole range of the hydrocarbon distillates is scheduled as follows:

	Boiling Point Deg. F.
Rhigolene	113 to 140
Chymogene	113 to 140
Gasoline	140 to 158
Benzine C	158 to 248
Benzine B	248 to 347
Benzine A	248 to 347
Kerosene	338 to 482

In the early days of the industry, when gasoline was a by-product, it was limited to that as above stated, in which the distilling temperatures were between 140 and 158 degrees Fahrenheit. This distillate existed in crude oil to the extent of 1.5 per cent. It was soon found that there would be a shortage in the supply unless some other fuel could be found that could be used to advantage in automobile motor work, and naturally the distillers of crude oil expressed a preference for the use of heavier distillates of crude oil rather than to have the trade diverted to alcohol. All that seemed to stand in the way of the use of the heavier distillates was the rather poor working of carbureters, and one way to bring about a reform of this part of the automobile was to slowly but surely widen the range of the distillates in the mixture and gradually influence for the better performance of carbureters.

That this policy on the part of the distillers of crude oil was carried out is plain to be seen; each year brought about a change in the fuel to be had upon the market, and the time finally arrived when it was found that the character of the fuel was so heavy and non-volatile that it would not give a reasonable measure of satisfaction when used in the ordinary way.

That this policy on the part of the distillers of crude oil is to be looked upon as an imposition is not believed; the price of every commodity advances as the demand increases, and in the case of (real) gasoline, had it been maintained, the demand would have been so great that the price would have been prohibitive even before the automobile industry reached one-quarter of its present proportions.

But the time has come when it will be necessary to consider further encroachments on the residuum of crude oil in favor of fuel for use in automobile motors. Of all the available distillates between rhigolene and kerosene 50 per cent. belongs to the latter. If this supply could be utilized the whole situation would be enormously relieved, and that some kerosene is now finding its way into automobile gasoline is believed.

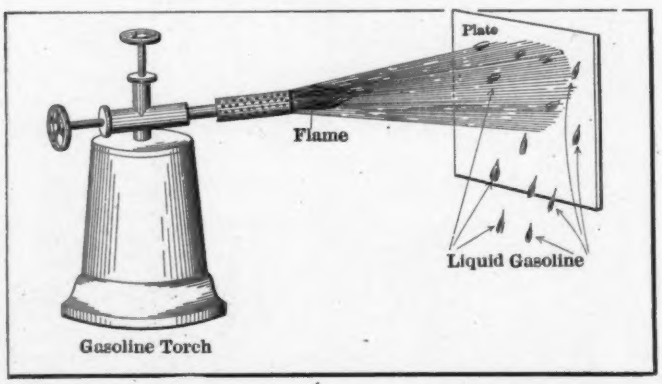


Fig. 1—Experiment using blow-torch indicating non-burning qualities of heavy distillates in the presence of highly volatile hydrocarbons

To whatever extent kerosene is added to the fuel that is now being furnished to autoists, it is just as much of a waste as so much water, unless the carbureter is so designed that it will heat the liquid gasoline and vaporize it before it is allowed to enter the combustion chamber of the motor.

The claim will naturally be made that there will be plenty of heat in the combustion chamber of the motor to vaporize the kerosene if it is present, and that it will be used as fuel under these conditions. Every autoist who is having trouble due to the formation of carbon in his motor is ready to testify to the fact that there must be something the matter with the explanation that fails to explain, and the time is ripe to point out that it takes more than heat to render kerosene oil combustible, and oxygen forms the remaining link.

True, there may be enough oxygen taken in with the fuel to serve for the purpose, but even then it is more than likely that the oxygen will not have time to mix with the fuel after the latter is vaporized within the cylinder, and, unless it does, the fuel will "crack," forming carbon, which will settle upon the surfaces of the cylinder, there to remain until it is scraped off.

That carbureters have been improved from time to time in keeping with motor requirements and the fuel problem is a settled matter, but it is becoming more apparent every day that

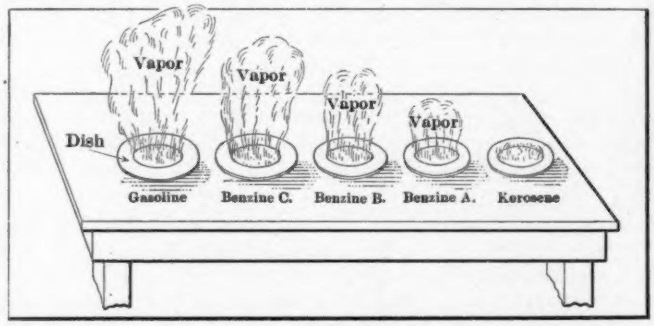


Fig. 2—Dishes holding the several distillates showing the rate of evaporation of each

the end is not yet, and autoists are complaining of the troubles they are having with growths of carbon, and the considerable quantity of residuum that has to be thrown away. But this is not all; smoke ordinances are rapidly being promulgated, and that poor combustion is one of the most prolific reasons for the smoke nuisance is too true to be ignored.

If there is one thing above another that the autoist of experience dislikes it is the odor of partially burned gasoline; the pungency of the odor is only equaled by the poisonous effect it will have upon the system of the autoist, and these are additional reasons why it is necessary to keep everlastingly at the carbureter problem, not so much with the expectation that a perfect one will ultimately emerge from the brain of some wonderful thinker, but that the pace will be maintained, it being a contest between:

(A) Decreasing volatility of automobile gasoline, due to the growing use of kerosene in the mixture.

(B) Greater demands on account of the improvements that are being made in motors.

(C) More exacting requirements on the part of autoists who appreciate the fine qualities of flexible motors.

Peculiarities of Composite Mixtures of Fuel

When gasoline is made up of certain percentages of gasoline, benzine and kerosene, admitting that each produce has its own

degree of volatility, the whole volume of fuel will not burn at the same rate, even if it is all set on fire at the same time. Fig. 1, of a torch of the kind in common use by repairmen, shows how some of the gasoline burns and the major portion of it passes through the flame and splashes up against the plate that is placed quite a distance away, but in line. What does this signify? It is proof of the fact that some of the fuel is so slow burning that even in the presence of an excess of atmospheric air, and plenty of flaming gasoline to ignite it, even so, it will not burn readily.

There is another very simple way to show that there is a great difference in the volatility of the respective contents of gasoline. Purchase a specimen of each of the distillates, as true gasoline, benzine C, B and A, also kerosene, and put a given weight of each in as many saucers placed in a row as indicated in Fig. 2, where a draft of air may strike them, and note the time taken for each content to evaporate. It will be found that the gasoline will evaporate very much faster than the benzine C, and that benzine C will evaporate faster than benzine B, but that benzine A will be slower than B, and that kerosene is very slow indeed.

Sizes of Globules Also Have to Be Considered

That the globule structure of each of the distillates is not the same may be proven by putting gas made from each of the distillates into rubber tires under pressure, when it will be found that the pressure will not fall in each of the tires at the same rate, thus indicating that the several products have different characteristics in this regard.

In liquid form, under pressure, when the several liquids are projected from nozzles, they will not all perform the same;

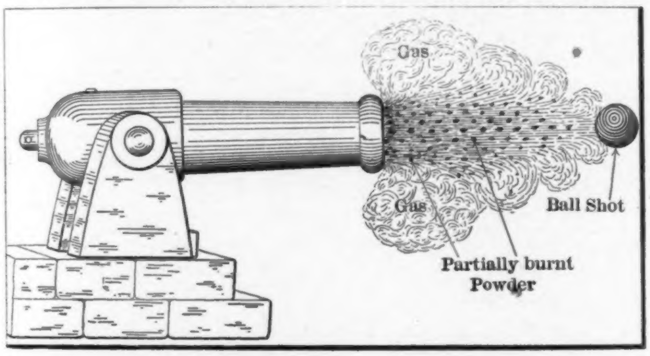


Fig. 3—The firing of a cannon taken to illustrate the action of the various distillates used in automobile gasoline

some will split up sooner than others, and this characteristic must also be considered when an attempt is made to gasify the several liquids. Now, what does happen? How is this point to be illustrated to bring it home clearly to the man who has no time to study the situation at length? Perhaps a cannon will suffice for the purpose; when a ball is shot from the mouth of a gun the partially burnt powder, and much smoke, comes out of the mouth of the gun, looking as shown in Fig. 3.

It is easy enough to understand that the ball travels faster than the partially burnt powder and the smoke. Why, then, will it not be easy to understand that the partially burnt powder will travel faster than the smoke? Of course it does. What is the result? Just what the illustration depicts. How is this phenomenon related to the questions of fuel and carburetion? If it will be remembered that heat must be absorbed by liquid gasoline before it will vaporize, and that it takes substantially 0.500 B.T.U. of heat to accomplish the task, one phase of the problem will be in a fair way to a proper understanding. But if heat is necessary to accomplish the task, the next question is, how shall the transfer be made with certainty and within the time limit, which, in this work, is very short?

Heat will transfer from one body to another if there is a difference in temperature between them, and the amount of heat that will exchange will be directly proportional to the difference in temperature. But there must be surface as well. Of course, each particle of the gasoline as it is ejected from the nozzle has surface, but the area of that surface will not be the same for all unless all are of the same size. Are all of the globules of gasoline of the same size? Unfortunately, no.

Even the differences in the sizes of the globules of the gasoline from the nozzle would not make so marked an effect on the final result were it not for the law of spheres.

The surfaces of spheres as they relate to mass are illustrated in Fig. 4.

What does it signify? With gasoline as it formerly obtained, that is to say, true gasoline, the significance was worthy of note, but it was far below that which must be noted with composite fuel such as automobile gasoline.

The illustration, Fig. 4, involving spheres, shows that the mass increases at a rate higher than the surface. The result is that the larger globules of gasoline will require a much longer time in which to vaporize, assuming a fixed difference in temperature for all.

But if some of the globules are composed of the less volatile products, as kerosene, the trouble is far greater. With kerosene as compared with gasoline, even were the globules of the same size, the gasoline would evaporate with great speed as compared with the kerosene.

The problem, then, in view of the actual presence of a double complication, is one that must be solved on a basis that will check with the demands of the controlling laws.

Just What Must Be Done to be Successful

Granting that the problem is one which has for its foundation the delivery of an efficient mixture into the combustion chambers of the cylinders of the motor, free from liquid fuel, the situation may be re-stated as follows:

(a) Account must be taken of the fact that all the globules of the fuel, as they spout out of the nozzle of the carbureter, will not be of the same diameter, partly due to the action which goes on in the nozzle, and largely on account of the composite nature of the fuel.

(b) When the fuel issues from the nozzle of the carbureter it must be screened, that is to say, all the globules of the same volatility and size must be allowed to mix with the stream of air and be vaporized in quantity sufficient to afford a capable mixture.

(c) The globules of low volatility and larger than those available for instant use must be screened out and held in a trap until they absorb enough heat to vaporize them, after which the vapor must be taken up by the inrushing air, but this process must not upset the normal balance of the mixture.

(d) Means must be at hand for promptly adjusting the quantity of air in proportion to the changing needs.

One of the facilities demanded under the circumstances is a source of heat.

What is the best source of heat? That which will afford a constant temperature and as many heat units as the demands in view of the latent heat of evaporation of the gasoline, to-

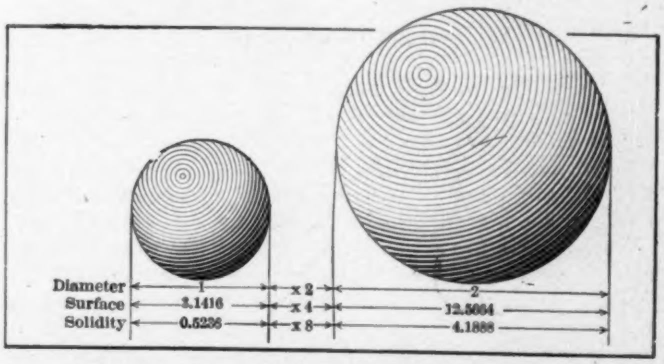


Fig. 4—Placing two sizes of spheres to elucidate the text in relation to the sphere law

gether with the requirements as based upon the specific heat of the air and the vaporized liquid.

Heating the air as it rushes into the carbureter is not in accord with the requirements; there is no way of accomplishing this so that the air will always remain at a constant temperature, and, unfortunately, the temperature of the air so heated is lowest just when it should be highest.

Heating the gasoline before it sprays out of the nozzle offers attractions, but this plan has the misfortune of disturbing the balance, due to the fact that the quantity of gasoline that will issue from the nozzle in a given time depends upon its viscosity and this property changes with the temperature of the liquid. A more stable method of heating depends upon the use of water circulating through a properly contrived jacket around the depression chambers of the carbureter. The water is heated to substantially a constant temperature in the cylinder jackets of the motor, and it is maintained at the working temperature by the radiator. True, even water under such conditions does not hold at a constant temperature level, but it is far more constant than heated air. The temperature of the water is high enough to serve for the purpose, and it is poor economy to heat the fuel higher than just the temperature that will suffice for the needs.

Fig. 5—Section of a snail-like curve offered to illustrate the principle of the vortex

If the large globules are screened out of the train and held in a trap until they vaporize, the working temperature may be held at a far lower level than would be true under other conditions. This idea, then, has more than the ordinary merit.

How is it possible to screen out the large globules of liquid fuel and hold them in "limbo" until they take on enough heat to reduce them to a stage of vaporization? How does the cream separator separate the butter-making contents from the milk, leaving skim milk as a residuum? Shall we call it a vortex action, for short, or shall we quote such of the laws of Newton as justify the contention as it is manifest in the illustration of the cannon ball and the products of combustion of powder? At all events, centrifugal force is imparted to all the particles that are engaged in the vortex swirl, and energy will reside in each of the particles independent of the other on a basis of:

$$E = \frac{W V^2}{2g}$$

When,

E = energy stored in the mass;
W = weight of the mass;
V = velocity in feet per second;
g = force of gravity.

Since the large globules weigh more than the smaller ones, does it not stand to reason that they will reside in a more pronounced state of energy, and, if this is so, is it not a fact that they will part company with the smaller globules, flying out at a tangent for a great distance, unless they are restrained?

What is there to restrain them? Certainly nothing within the body of forming mixture worth taking into account.

When the forming mixture is given the swirling motion as in a vortex, and energy is imparted to the respective globules of fuel in proportion to their respective weights, the larger and heavier globules will work up and out, so that after a few revolutions all the heavy particles will be found on the outer rim of the swirling mass and all the "mist" particles will work in toward the center, or, properly speaking, will be crowded in toward the center or core of the vortex, as shown in Fig. 5.

A Point That Has Never Been Discussed

It will be remembered that the best mixture of gasoline and air is in the proportion of 8,000 parts volume of air to one volume of liquid gasoline; it is also claimed that the richest mixture that will burn has 3,500 volumes of air to one volume of liquid gasoline, and the leanest mixture that will ignite has 10,000 volumes of air to one volume of liquid gasoline. Plotting a curve of these values presents an angle that is even a little startling, as Fig. 6 will show. Of course, the nearly exact proportion of air to gasoline for the best result in practice depends upon the compression; if the compression is very high, more air must be used. The reason for this lies in the fact that the time allowed for the proper mixing of the air and the fuel will be lowered, due to the higher obtainable speed under conditions of higher compression.

The curve, Fig. 6, looking at it from this angle, indicates that rich fuel proportions will work satisfactorily at the lower speeds, and that the torque of a motor should be maximum at the lower speed; also that it will not hold constant at all speeds.

The problem in carburetion is to realize the greatest possible torque at low speed and to fight off the tendency of the torque to fag as the speed is increased.

The way to accomplish this is to sort out the globules of less volatile gasoline and give them time to vaporize; then allow the vapor to enter the train and to be turned to good account in the combustion chamber of the motor. The vortex idea is put forward as a good one for work of this character, and the result in practice of the utilization of this idea is shown in the curve, Fig. 7, of performance of a 4-cylinder, water-cooled, 4-cycle motor of conventional make, with cylinders of 5 1-2 inches bore and 6 inches stroke.

In this curve the ordinates are plotted for speed, and the abscissæ are given values in horsepower. The curve is almost straight between 550 and 1,300 revolutions per minute of the crankshaft of the motor delivering 68.2 h.p.

A closer inspection of the curve discloses a slight kink in the same at 60 horsepower, which was delivered at 1,090 revolutions per minute. At about 1,350 revolutions per minute the curve takes a sharp fall; this is a sign that the motor valve system reached the limit of its capacity; it is not a sign of lack of ability of the carbureter in this case. Were the carbureter at fault there would be other indications, as a wavering of the curve before the knee of the same was approached.

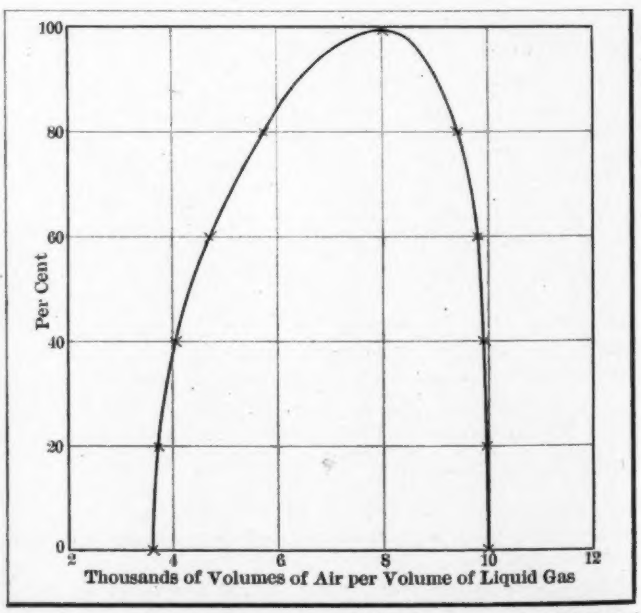


Fig. 6—Curve plotted to show the relations of air to gasoline as it is employed in motor work

It is true that the relation of speed to torque of a motor may be calculated as follows:

Let,

H.P. = Horsepower of the motor;
R = Radius of the lever arm;
S = Speed in revolutions per minute;
P = Pull in pounds at the end of the lever arm;

When,

$$P = \frac{H.P. \times 33{,}000}{6.28 \times R\,S}$$

Taking the case in point, the value of the torque at 600, 900 and 1,200 revolutions per minute is:

At 600 revolutions per minute:

$$P = \frac{34.3 \times 33{,}000}{6.28 \times 1 \times 600} = 303.2 \text{ pounds.}$$

At 900 revolutions per minute:

$$P = \frac{50.4 \times 33{,}000}{6.28 \times 1 \times 900} = 294.2 \text{ pounds.}$$

At 1,200 revolutions per minute:

$$P = \frac{64.8 \times 33{,}000}{6.28 \times 1 \times 1{,}200} = 283.6 \text{ pounds.}$$

Assuming that the best torque was realized at 600 revolutions per minute, which is a fair assumption, too, it is shown just how much the torque faded as the speed increased, but unfortunately it is not possible to state with certainty that this falling away of the torque is due to ills of carburetion; it may just as well be due to valve and other losses. It might be a reasonable statement of the situation that some of the falling is due to valve and other motor trouble and the rest to carbureter limitations, but it will be observed, nevertheless, that the performance is extremely good.

With a view to showing in a relative way the excellence of the performance as above referred to, reference may be had to Fig. 8, which is a speed and torque curve of a racing motor with a bore of 6 1-2 inches and a stroke of 6 3-4 inches, working 4-cycle, water-cooled. This motor was fitted with a Mercedes type of carbureter, was tuned up to the best point, delivering 66 horsepower at 1,000 revolutions per minute and a study of the chart would indicate that the power realized is none too satisfactory, due, to some extent, to poor ignition, but experience indicated that the mixture was not uniform over the whole range, which accounted for the falling torque.

The Effect of Time and Service Should Be Considered

The fault in the average record of the performance of an equipment is due to the fact that it is made under laboratory conditions. The effect of time and commercial service is not there reflected, and in this connection, referring particularly to carbureter work, there are too many chances against good commercial service, even though the laboratory situation may be something to whet enthusiasm.

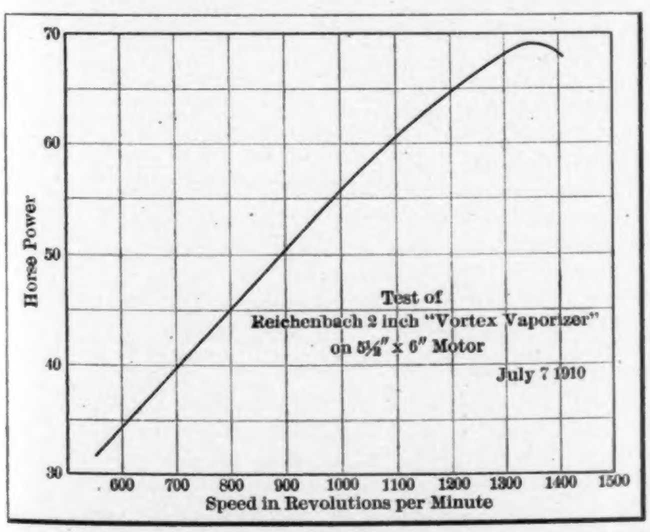


Fig. 7—Curve of performance of a Vortex carbureter on a motor

Take, for illustration, the surface indications as carbureters are used on automobiles in general. In some cases the refrigerating effect, which is produced by gasoline during vaporization, is indicated as frost upon the surfaces of the carbureter, and also

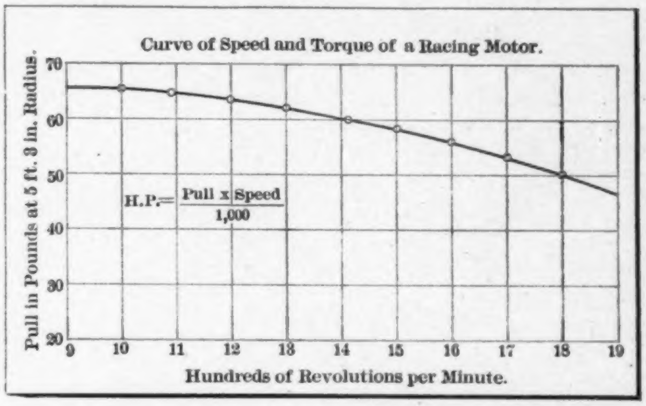


Fig. 8—Curve of torque and speed performance of a racing motor

over the cooler portions of the intake manifold. The average autoist very properly reaches the conclusion that heat is not being supplied to the vaporizing gasoline at a rate sufficiently high to prevent the lowering of the temperature down to the frosting point. But suppose there is no surface indication of this character. That fact does not prove that heat is being supplied to the liquid fuel on a basis to produce gas out of the same. It might be true, under such conditions, that the liquid fuel is not vaporized until it contacts with the highly heated surfaces within the combustion chamber with a small interval available to complete an operation that requires time.

Every autoist has a fair insight into the history and methods of the average charcoal burner, and it is quite well understood that he burns the wood in the absence of sufficient atmospheric air to produce a flame, and the product is in the form of charcoal. To tell autoists, however, that gasoline, if burned in the absence of sufficient air to produce complete combustion, also produces coke is to reach beyond their normal way of thinking. Fig. 9 is offered to serve as an illustration of the fact that liquids high in carbon will form coke under certain conditions, just as coke is formed out of wood. (A) Fig. 9 is a section of a coking oven on a small scale, the coke being in the hermetically sealed chamber at the top, the fire being made in the middle chamber, and the ashes from the burnt wood of the fire fall through the grate to the pit underneath. The oven at the top is primarily charged with wood, thereafter sealed and when heat is applied for a sufficiently long time the volatile matter is distilled out of the wood, leaving coke as a residuum. The reason coke forms lies in the fact that the chamber is hermetically sealed, thus excluding oxygen, and without oxygen the coke (carbon) cannot burn. (B) Fig. 9 shows the cylinder of a motor in section, with deposits of carbon adhering to the combustion-chamber surfaces and to the head of the piston. This combustion chamber in the cylinder of the motor is in every sense of the word a precise equivalent of the hermetically sealed chamber in the coking oven. When gasoline enters, if there is not enough atmospheric air with it to supply the requisite quantity of oxygen to burn the inflammable constituents of the gasoline, the portion that is deprived of its oxygen mate will remain in its original form. The inflammable constituents of the fuel are composed of carbon and hydrogen. The hydrogen is much more energetic in its search for any oxygen mate and burns first. The laggard carbon, in the absence of the right amount of oxygen, is therefore left in the lurch, and a part of

it remains unattached, thus forming coke somewhat intermingled with lubricating oil, and the pasty mass spreads out over the adjacent walls, where it will remain until it is removed by mechanical means. Since there is about 83 per cent. carbon in the gasoline, it is not difficult to understand why carbon trouble becomes acute in automobile motors within a very short time if the conditions of carburetion are faulty.

In the Reichenbach Laboratory at 2420 Michigan Boulevard, Chicago, Ill., a series of tests were conducted for the purpose of ascertaining something of the facts in relation to the phenomena of carbureters. Fig. 10 presents one of the experimental devices that was rigged up to prove that gasoline would not vaporize when sprayed out of a nozzle, excepting when the conditions were such as to bring about the full heat exchange required to satisfy the latent heat of evaporation of the liquid, and the specific heat of the inrushing air. In this illustration C1 is the carbureter bowl, B1 is a base for the glass dome, P1 is the gasoline pipe leading through an orifice at the center of the base to the nozzle N1, which is scarcely discernible through the last dome, but is indicated by the dotted lines and an arrowhead. Suction is induced by the pipe P2, so that a depression is created in the glass dome, and, the latter being transparent, the nozzle action may be seen. With ordinary nozzles, and the suction that obtains under average conditions in automobile work, a stream of gasoline shoots up and splashes against the top of the dome. The more volatile portions fray out and form a mist around the solid stream, but the central core remains in continuous liquid form, which is proven by the force exerted as it splashes against the top of the glass dome and splatters down. It was found that by introducing a proper form of Venturi tube with tangential air passageways in juxtaposition to the nozzle a vortex was formed, and the solid stream as previously noticed no longer obtained. Instead of the gasoline streaming out of the nozzle, it formed in a spiral, attenuated sheet, with a certain separator action, so that the more volatile portions of the gasoline are free to rise and the resisting globules are thrown against the retaining walls with considerable force, where they are flattened out or shattered, thus rendering them more amenable to the further vaporizing process, and hastening the desirable action.

As a direct result of the series of experiments referred to, the vortex idea was incorporated into a carbureter, as shown in Fig. 11 in plan elevation and section.

Plan Elevation and Section of Model L Vortex Carbureter

In service, this carbureter performs as follows: Gasoline enters at E1, is controlled by the needle valve V1, which is pressed home by a spring S1, and when the gasoline falls below the level of the nozzle N1 the concentric float F1 drops down also until it rests on a lever arm L1, which has an upward projecting extremity E2 that presses against the action of the spring S1. These are all details that are not very different from carbureter practice in general, and the real matters to be enlarged upon are involved in the use of a detachable Venturi tube V2 with tangential air openings A1 and A2 located in the Venturi tube at a point somewhat below the top of the nozzle N1. A needle valve N2 is provided by means of which the gasoline flow from the float bowl to the nozzle may be pinched off or regulated. A catch basin B1 is located below the Venturi tube, concentric with the needle valve, with a means for vertical adjustment for the purpose of influencing the depression in the Venturi tube, and for the further purpose of catching a supply of gasoline which will pour into it when the motor is being started, thus facilitating the starting operation. Above the needle valve and the Venturi tube the mixture in passing contacts with a long thin water jacket wall J1, the water being in the jacket W1 and W2, entering at the orifice E3. Above the long water-jacketed wall there is a damper D1, by means of which the flow of mixture is more or less interrupted on its way to the motor through the manifold. Extra air is admitted through the snail-like passageway E4, and, referring to the plan, it will be observed that a rectangular gate G1 is placed over the orifice of the snail-like passageway E4, serving in the capacity of a clapper. The liquid gasoline as it resides in the float-bowl B2 is maintained at a substantially constant temperature, and heat is prevented from transferring from the surroundings to the liquid by means of insulation placed for the purpose, the idea being to maintain the liquid gasoline at a constant viscosity, thus regulating the flow of the same through the nozzle so that it will be constant for a given depression. It was found experimentally that the flow of gasoline through the nozzle into the depression chamber as formed by the Venturi tube was broken up into mist, due to the tangential action of the air sweeping through the passageways A1 and A2, and it was further ascertained that the less volatile particles were thrown up against the thin tube J1, to which they tenaciously adhered until, by virtue of the heat transfer from the water jacket, they were dissolved into a gas.

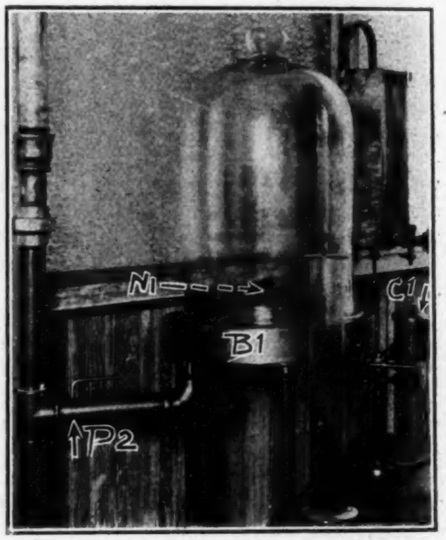


Fig. 10—Experimental equipment employed for the purpose of proving that gasoline does not vaporize at the nozzle of a carbureter

Entrained globules of liquid gasoline that might get by the passageway formed by the tube J1 are taken up in the vortex generated by the auxiliary air which sweeps up by the clapper G1 through the snail-like passageway E4 into the space between the top of the tube J1 and the snubbing damper D1, and thrown out of the direct current of mixture against the walls W3, adhering thereto until these globules are dissipated in the process of forming gas.

It will thus be seen that the initial mixture, although it may be rich in gasoline, is nevertheless rendered dry, due to the swirling action of the air as it passes through the tangential passageways surrounding the gasoline nozzle, leaving the nonvolatile globules adhering to the hot walls of the tube J1, and the rich mixture passes on engaging with the auxiliary air in

Fig. 9—(A) Section of a coking oven showing how coke is made; (B) Section of a motor cylinder showing how coke is made out of gasoline

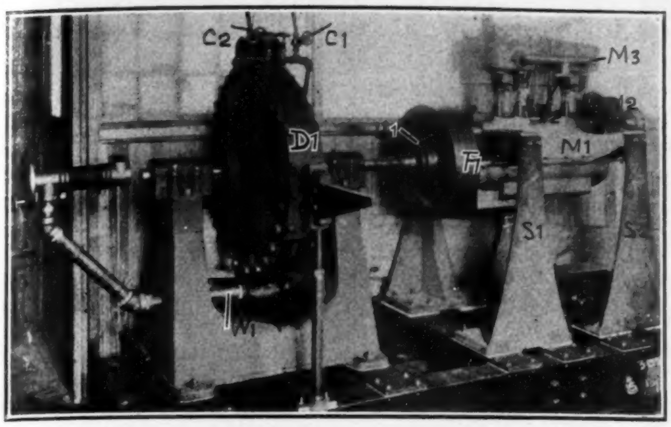


Fig. 11—Hydro-dynamometer designed for testing purposes in the laboratory used for proving the qualities of carbureters

the vortex chamber above. Owing to the lack of volatility of much of the liquid that now finds a resting place in automobile gasoline, it is to be expected that some of the liquid particles will work up into the vortex chamber before they are completely dissolved, but they will be there swept with considerable force against the retaining walls, where they will be shattered by mechanical battering, and will drop down onto the hot platform below, there to remain until the gas formed out of them will tell the tale of their complete annihilation.

The one remaining consideration of unusual purport lies in the means of adjusting the clapper G1 over the orifice of the snail-like passageway E4. This is brought out clearly in the plan showing a contoured finger F2 in rigid relation with the shaft to which the clapper G1 is also rigidly attached, so that when pressure is applied to the finger F2 the clapper G1 is forced open. Force is applied to the finger F2 by means of the bell crank B3, which in turn is actuated by a spring S2 pressing against one arm of the bell crank B3 at one end, and an abutment A3 with an adjusting screw A4, having a knurled head, which if turned in one direction puts tension upon the spring, and vice versa. The object in having the finger F2 suitably profiled along its face is to facilitate the action involved in opening the clapper G1. When the carbureter is running, furnishing a rich mixture, as when the motor is being started, the extremity of the bell crank B3 presses against the point P1 of the finger F2 and the clapper G1 remains substantially closed. As a further means of adjustment the slot S3 permits of moving the base piece B5 in or out with a set-screw S4 available for locking. The effect that this in-and-out movement of the base piece induces is to alter the line of pressure of the face of the bell crank B3 where it engages the face of the finger F2 and in this way the opening and closing of the clapper G1 is made early or late as the exigencies of service would seem to demand. As the clapper G1 opens, the line of contact between the finger F2 and the bell crank G3 shifts in the direction of the extremity of the finger F2, and is shown at P2 in the plan. The adjustment is extremely delicate, and is rendered permanent by the means afforded, so that having set the carbureter in the position of rich mixture for starting, the various other mixtures are obtained automatically over the complete range of performance of the motor, up to the limit as shown by the curve of motor performance presented elsewhere in this article.

In order to be able to test this type of carbureter under conditions of actual service, it was applied to various automobiles and as the result of these practical trials an insight was gained into the mechanical shortcomings of the original design, but simultaneously a series of laboratory experiments were conducted, and it was finally decided to install a dynamometer as shown in Fig. 11 for testing purposes in which M1 is the motor, M2 the magneto, S1 and S2 the stands, F1 the flywheel, U1 the universal joint connection and D1 the dynamometer, with its water entrance W1 at the bottom, and means of control C1 and C2 as shown. The carbureter manifold M3 is of the ordinary type and the carbureter to be tested is bolted to the flange F2. This form of dynamometer affords the means of operating carbureters under a wide variety of conditions, giving the range of performance degrees of flexibility, and indicating with great clearness the dead points as they obtain in carbureters in general.

As the direct result of a long series of investigations, utilizing the most advanced facilities, and persisting, the Reichenbach Laboratories Company arrived at the conclusion that the Vortex carbureter is in conformity with the best requirement, satisfying the principles as hereinbefore enumerated to the exclusion of the troubles so clearly brought out.

Effect of Kinetic Forces on Motors

In view of the presence of reciprocating and rotating parts in a motor, the movements of the parts will set up in the members a system of forces on a kinetic basis. The members that are most responsible for these forces are: (a) the piston, (b) wrist-pin, (c) part of the weight of the connecting rod. Variations in the frictional effort as the piston travels in the bore of the cylinder will also have some influence toward generating secondary moments which may be assigned to the reciprocating class owing to the fact that these variations come on account of the travel of the same. But if the variations of friction have to be considered, it follows that variations of gas pressure and of back pressure will also have to be taken account of.

The manifestations of these hidden forces comes in the form of a modification of the angular velocity of the crankshaft and the flywheel. There will also be a system of unbalanced forces acting upon the frame of the motor. The rotating members as crankshaft, flywheel, camshaft, half-time gears, etc., will induce similar rocking effects, depending upon design, weight, speed and condition of lubrication, but they will not be so marked as those effects which are induced by unbalanced reciprocating masses.

The kinetic forces, under the circumstances, may be divided into two classes: (a) reciprocating and (b) rotative. In a sense, the connecting-rod forces belong to both classes; these members not only reciprocate, but they rotate as well. In the solution of

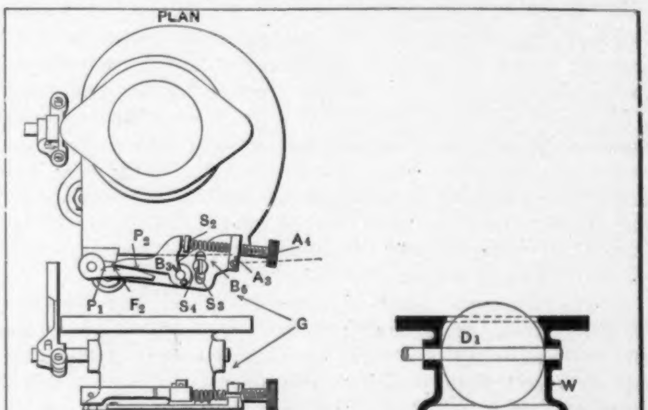


Fig. 12—Plan, elevation and section of the Vortex carbureter showing the Venturi tube, tangential ports and snail-like chamber

the problem invoking the extent of the rocking of the frame and other vibrations set up, it is necessary to attack the matter from four points of view as suggested by Professor Dunkerly, i. e., (a) solve for the resultant force to give the rod its combined motion, (b) plot the inertia of the connecting rod on the crank-ing-effort diagram, (c) solve for the displacing force on the frame, and (d) determine the bending force on the connecting-rod due to its own inertia.

Should it be desired it is possible to solve for the equivalent inertia forces at the wristpin, it is a choice which adds but little complication, and certain advantages are present in the plan. At all events, in the final sum up, it is necessary to fix the turning moment, rocking effect on the frame and the stresses in the members, in order to proportion their sizes with safety, or forecast the amount of rocking so that it will be possible to decide as to the desirability of changing the form if there is too much to tolerate.

In designs as they obtain, it is barely possible that the greatest mistake comes from assuming that a good static balance of the members is of the first importance. It is quite possible to have a condition of good static balance and an augmented display of kinetic trouble in consequence. In such cases it is better to depart from a condition of perfection static balance enough to correct the kinetic conditions to obtain the best average result.

If a tire is below size it will not inflate to roundness under any pressure that can be applied.

Composition of Steel and Permanent Magnets

To make permanent magnets that will do just as good work as can be accomplished when the magnets of a generator are wire wound, it is necessary to employ a grade of steel that will deliver a high flux density and hold the property termed "retentivity" to a marked degree. It is unfortunately true that most grades of steel, when they are subjected to the hardening process, afford but a low flux density and are only partially retentive. Plain tool steel, while it will serve for this class of work, is not nearly so efficacious as some of the grades of alloy steel, and of the alloying elements available tungsten seems to be best. The very latest practice in Germany involves the use of tungsten, but the steel is made in the electrical furnace and the carbon is well regulated. In addition to this the material is rendered of high specific gravity, which is one of the claims for electric furnace steel. The composition of this particular brand of steel is as follows:

Chemical Composition:

Tungsten	6.00 per cent	Silicon	.20
Carbon	80 points	Sulphur	.03
Manganese	80 points	Phosphorus	.015

Just why the electric furnace is the most appropriate for the turning out of magnet steel is a matter that will have to be disposed of after some study, but it is important to note that there is quite a difference in the structural appearance of steel made in this way as compared with products of the crucible pot, or from the open hearth.

New Carbureter Principle

ILLUSTRATING A NEW IDEA IN CARBURETION INVOLVING THE USE OF A DIFFERENTIAL COMPENSATING VALVE AUTOMATIC IN ITS ACTION WITHOUT INTERFERING WITH HAND-CONTROL

RECOGNIZING the utter impossibility of anticipating the needs of a motor from the mixture point of view, many designers have struggled with the automatic carbureter problem. It would be a simple undertaking to supply mixture to a motor were it to run at a constant speed and under a fixed load. This cannot be true in automobile work, for the reason that the power required depends upon the speed at which the car is driven, and upon the road conditions. Even if the road were to be level and hard, thus eliminating troubles from this source, the carbureter problem would still be complicated, due to the fact that wind resistance intervenes; nor does the power required increase in direct proportion.

Strictly automatic types of carbureters have been designed, involving many mechanisms, and while they offered advantages more or less desirable, they nevertheless fell short of the exacting needs, so that the substitution of automatic means of control for hand-control had the force of swapping one set of troubles for another.

That the average motorist takes more kindly to hand-control carburetion than he does to the automatic system is believed to be true. This preference is due to the fact that while hand-control is prone to introduce dead spots in the range of carburetion, and shows the effect of lack of dexterity on the part of the operator, it eliminates the impossible condition which creeps in under automatic conditions when the range of performance of the automatic device falls short of the indicated requirement.

During the past two or three years autoists have complained of carbon trouble on an increasing basis, and they jumped to the conclusion that excess of carbon in the cylinders was due to some fault in the lubricating system. This idea led to the investigation of the lubricating oil problem, until to-day it is the practice of the average autoist to purchase the best lubricating oil that can be had, and to use it so sparingly as to risk damaging the motor as the direct result of restricted lubrication. It is now a fairly well-established fact that the amount of carbon that is likely to sift out of the lubricating oil and form a crust over the combustion chamber surfaces is too infinitesimal to merit serious consideration.

Before departing from this question of the troubles due to lubrication, it will be proper to state that the best possible performance will come if lubrication is profuse and with the understanding that the lubricating oil supplied will be suitable for the purpose. The fact that the lubricating oil is not at the bottom of carbon trouble does not afford a license for using the kind of lubricant that will crack under the conditions of operation involved. It will be understood, of course, that when lubricating oil does crack carbon will be precipitated. If it may be stated with certainty that the carbon troubles which motors seem to fall heir to are for the most part, if not entirely, due to poor mixture, it goes without saying that a proper remedy lies in the use of suitable fuel and a carbureter that will afford a mixture that will burn completely. The product of combustion, if carbon is to be kept from forming, must be nitrogen, carbonic acid and water. The nitrogen, being an inner gas, enters with the atmospheric air, and comes out unchanged. This part of the mixture, then, is a mere diluting agent, and since it leaves just as it enters it does no harm whatever, provided it is present in just the quantity required. In further relation to this content, it is pointed out that the gas engineers who claim that nitrogen is detrimental labor under the false impression that the mixture would be much more powerful were it not diluted with nitrogen. This contention is based upon fact, but it does not necessarily follow that the performance of a non-nitrogenous mixture would be satisfactory in a motor. The best performance comes when the rate of flame travel in the mixture is slow enough to permit the piston to sweep ahead of the wave of pressure at a certain rate. Referring to Fig. 1, which is a diagram of compression, ignition and expansion, presenting the idealized Otto

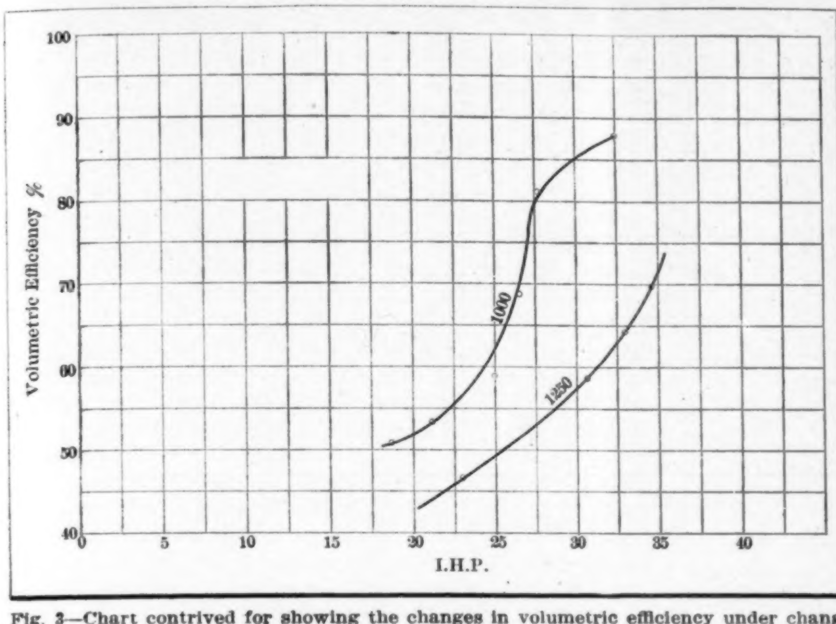


Fig. 3—Chart contrived for showing the changes in volumetric efficiency under changing loads with two different speeds

cycle, it will be observed that the ignition line 2 3 is straight. When the ignition takes place with sufficient speed to afford a straight line, then the rate of flame travel of the fuel after ignition is high enough to serve every proper purpose. That there should be no burning of the fuel during the expansion stroke is shown in this diagram, and is accepted as an established fact in practice. What is wanted, then, is the greatest possible filling of the cylinder during the suction stroke, which will be true if the inlet valves are large, the piston rings tight, and the cooling conditions are such as to maintain a constant and sufficiently low working temperature. With these conditions established, compression will take place on the compression stroke 1 2, ignition will follow, preserving the straight line 2 3, and expansion will take place without burning 3 4, all in Fig. 1. The exponent n_1 is given as 1.31 in the expansion curve, which represents a sufficiently high value of this exponent to indicate somewhat better working conditions than can be expected when the carburetion is poor. Confining the discussion to the merits of nitrogen, for the moment, it is pointed out that it seems to be in about the right presence for the proper dilution of well-contrived mixtures, and it is also worthy of note that it is not the nitrogen that produces trouble when the mixture is poor.

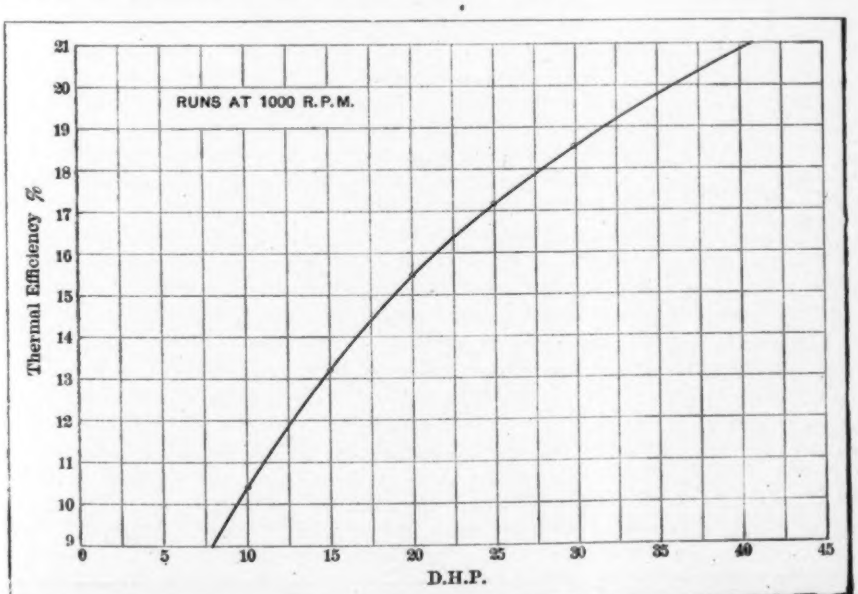


Fig. 4—Chart designed to indicate thermal efficiency under different loads at constant speed

Fig. 2 shows six indicator cards, which are characteristic of the performance under six sets of conditions, as follows:

(*a*) When the ignition is 25 degrees early;
(*b*) with the ignition 20 degrees early;
(*c*) with the ignition 16 degrees early,
(*d*) with the ignition 12 degrees early;
(*e*) with the ignition 5 degrees early.
(*f*) with the ignition 10 degrees late.

The card *d*, Fig. 2, is a good practical representation of what might be expected under normal conditions with good carburetion and with the ignition taking place while the piston is on the top dwell point, so that there is no burning during the expansion stroke. It will be seen, from a study of these cards, that the ignition problem must be properly cared for if the questions of carburetion are to be discussed intelligently, and with the understanding that the ignition will be on a basis of merit; if it is also assumed that the question of nitrogen in the mixture is one that can be set aside, it will then be proper to discuss the further problems which arise in this connection.

Properties of Gasoline and Other Hydrocarbons

Remembering that nitrogen is of the air, and in sufficient presence to serve for dilution purposes, the next step will be to consider true gasoline, which product has a specific gravity ranging between 0.680 and 0.710, with a boiling point as low as 140 degrees, and maximum at 158 degrees Fahrenheit, the chief constituent being hexane, the formula for which is C_6H_{14}. For perfect combustion each kilogram of gasoline requires 11.8 cubic meters of air, so that the proportion of liquid and air under conditions of perfect combustion is in the ratio of 12.4 to 100,000. It will be the same result if 2.15 per cent of the total volume of mixture is represented by the vapor of gasoline as above constituted.

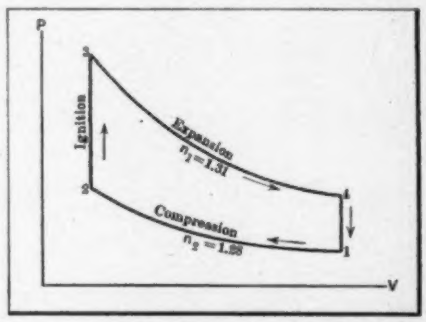


Fig. 1—Idealized Otto cycle, showing compression, ignition and expansion lines

There are two considerations that stand in the way of the realization of the best possible results, and the first of which lies in the fact that "automobile gasoline," which is the product available at the present time, differs from the true mixture as above outlined, and the second difficulty takes into account the variations that creep in when speed and load change. Were the speed to remain constant, and the load to change, that consideration would resent one phase of the problem, and should the load change and the speed remain constant, a second phase of the situation would be recognized, but unfortunately, in practice, both the speed and the load change simultaneously, which, together with the fact that the gasoline to be had is not uniform, adds very materially to the carbureter problem. Automobile gasoline, instead of being a single distillate, as hexane, is substantially composed as follows: Hexane, with a specific gravity of 0.676; pentane, with

a specific gravity of 0.640, and heptane, with a specific gravity of 0.718. The proportions by weight, considering a good grade of automobile gasoline, which is far from a good grade of gasoline proper, may be as follows: Pentane 2 per cent, hexane 80 per cent, and heptane 18 per cent; total, 100 per cent.

It is highly improbable that the available supply of automobile gasoline of the above composition is equal to the present requirement, and it is more than likely that octane, nonane, and even decane, will be found in much of the liquid fuel that is now sold over the counter. In proportion as the last three named distillates are introduced, hexane is left out of the mixture, and the volatility of the product as a whole falls off rapidly as hexane is eliminated.

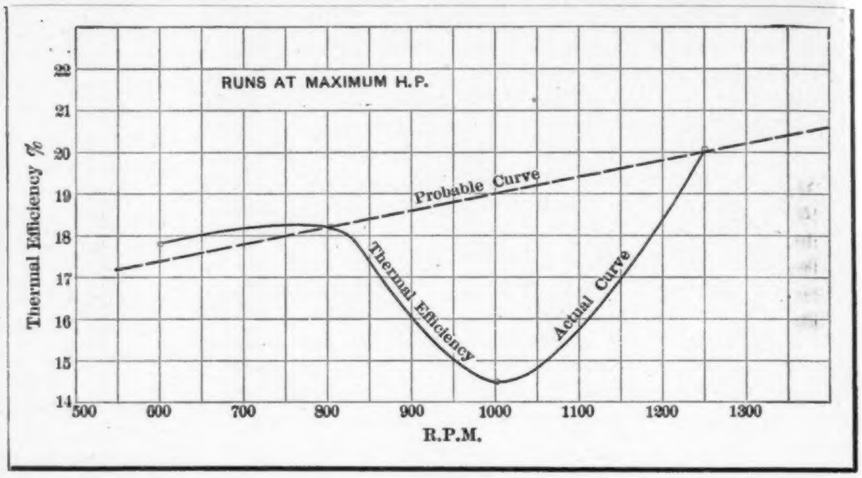


Fig. 5—Plotted to depict the variations in thermal efficiency at a maximum load, speed changing

The proportion of carbon in the typical automobile gasoline above named is 83.8 per cent, 16.2 per cent is hydrogen, and 3.5 pounds of air must be added to make the theoretically right mixture.

There is a great difference between figuring the theoretically right amount of air for complete combustion, and trying to find out how much air must be used under the conditions that obtain in practice. That there must be an excess of air is a recognized fact, and just how much excess there will be, when the conditions are most satisfactory, is almost beyond an estimate. All the variables mentioned have bearing upon this phase of the problem. Moreover, the excess of air must increase with increasing compression; in other words, a high compression motor requires a greater excess of air than that which will satisfy a motor with a lower compression, but, unfortunately, the actual compression in any motor varies with the speed of the same, and is affected by other considerations, as scavenging, which in turn is a variable depending upon some thermal considerations, back pressure offered by the muffler, the extent to which the carbureter serves as an obstruction in the intake, etc.

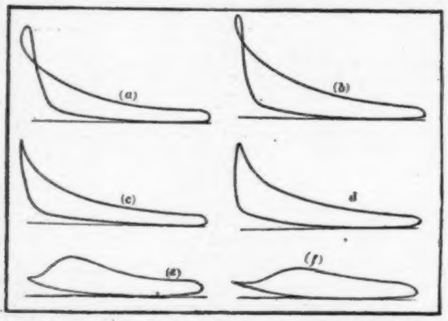


Fig. 2—Six indicator diagrams showing how the card varies with different ignition points

Carbureters Frequently Obstruct the Intake

It is one of the misfortunes in automobile motor work that the amount of gas which is permitted to enter the cylinders is below the best requirement, and, as Fig. 3 shows, the volumetric efficiency resulting is not only low but variable as well. In this chart, the abscissæ read horsepower and the ordinates are given values in per cent. of the volumetric efficiency. By volumetric efficiency is meant the extent to which the cylinder of a motor is filled with gas during the suction stroke to a point where the suction line crosses the line of the atmospheric pressure. The average layman may have difficulty in appreciating just what this means, but there is one fundamental point that should appeal to him, and perhaps by using a parallel the idea may be more forcefully introduced. For instance, the amount of heat that will be given off by the radiator system in the reader's own house will never exceed that which is represented by the heat units in the coal that is shoveled into the furnace. In the same way, the amount of power that can be taken from an automobile motor can never be greater than the amount of heat (minus losses) that is represented in the gas which is introduced by suction methods into the combustion chamber of the motor. In measuring the volumetric efficiency of a motor, it is a simple and comprehensive process by which the fuel is weighed, and if the amount of fuel utilized is below a fitting requirement, the thermal efficiency as measured in per cent will also be low. In determining the thermal efficiency of a motor, a manograph card is taken, and tracing the suction pressure, which is below the atmospheric line, will bring to notice the fact that this suction line crosses the atmospheric line at some point in the stroke. If the volumetric efficiency is said to be 70 per cent. then at a point 30 per cent. down on the suction stroke the line of suction pressure will cross the atmospheric line. The process involved, if a manograph is available, is very simple and reliable. Referring again to Fig. 3, there are two curves plotted, one of which is at 1000 revolutions per minute and the other at 1250. This chart very clearly indicates that the compression must have been lower at 1250 revolutions per minute than it was at 1000. Delivering 30 horsepower, the volumetric efficiency was 57½ per cent at 1250 revolutions per

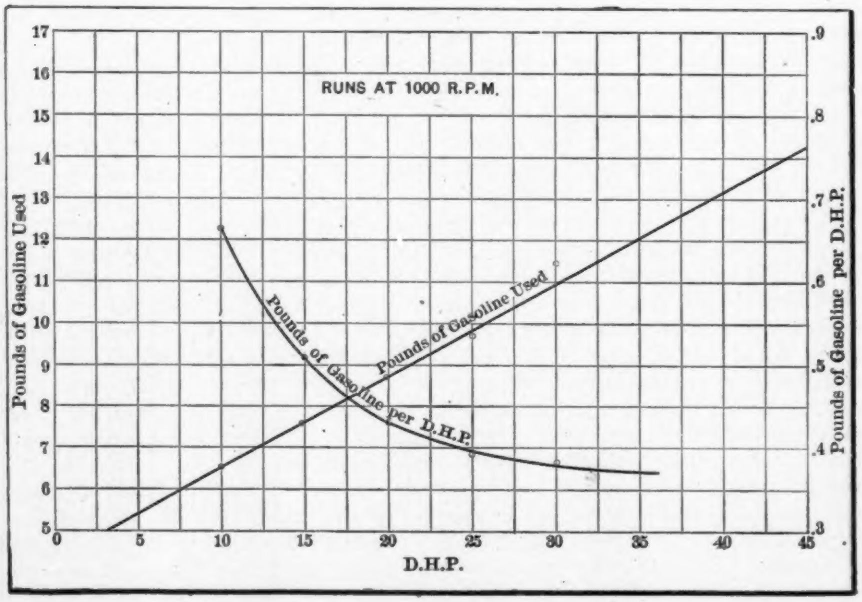


Fig. 6—Charted consumption of gasoline at a constant speed with varying load

minute. Delivering 30 horsepower at 1000 revolutions per minute, however, the volumetric efficiency was increased to 85 per cent. It stands to reason that the motor was doing more efficient work at 1000 revolutions per minute delivering 30 horsepower than it was when it delivered the same horsepower at 1250 revolutions per minute. True, the power was the same in both cases, but the amount of gasoline required was considerably greater at the higher speed.

When the volumetric efficiency of a motor is lowered by increasing speed, even assuming the power delivered is the same as at some lower speed, the thermal efficiency falls off with the decreasing volumetric efficiency. Just how the thermal efficiency varies with horsepower at a constant speed is shown in Fig. 4, in which the delivered horsepower is represented by ordinates, and the thermal efficiency in per cent. is shown on the scale of abscissa. This particular motor showed a thermal efficiency of 18.6 per cent at 30 horsepower and 1000 revolutions per minute.

By thermal efficiency is meant the percentage of the total heat units available in the fuel that are turned into useful work. When the thermal efficiency is 100 per cent all the heat units in the fuel will be turned into useful work. The best thermal efficiency available in steam practice ranges between 8 and 16 per cent, whereas the best thermal efficiency in internal combustion motors ranges between 12 and perhaps 22 per cent. There are a few isolated instances of a better thermal performance of certain types of internal combustion motors, but it is not believed that automobile types of internal combustion motors reach beyond 22 thermal efficiency. This is a very high value, however, and it is one that is never reached in actual practice, owing to the imperfection of carbureters and wide variations in the actual load as well as speed variations of the motor. Just to show how speed changes affect the thermal efficiency, under conditions of maximum load of a motor, Fig. 5 is given in which speed is represented by ordinates, and the thermal efficiency is given in per cent, on the scale of abscissa. In this case, the dotted line, representing probable curve, differs from the plotted curve, due to influences which were beyond the ability of the testers to observe. If the dotted line of probable performance is taken as true, the thermal efficiency was 17.3 per cent at 600 revolutions per minute, and increased to a point slightly above 20 per cent at 1250 revolutions per minute. This curve was taken from a Franklin air-cooled motor, during a series of tests which were made under the direction of Professor Rola C. Carpenter, Sibley College, Cornell University. For the purpose here, it serves every end, and while the actual thermal values might move up and down the scale more or less, depending upon the motor used, the fact remains that the thermal efficiency is not constant with variable speed and fixed load, nor can it be constant with variable speed and variable load.

There is one other point that must not be lost sight of in considering these curves. The tests were made in a laboratory with instruments of precision of every kind available, and they were conducted under the direction of Professor Carpenter, who also had at his disposal a large number of trained assistants, so that the tests were all run after the motor was carefully tuned up, and the records taken were those showing the best obtainable results, which means that the carbureter was hand-adjusted, and manipulated until it showed its maximum capability. On the road, under normal working conditions, there is no method available by which the driver of a car can tell when the carbureter is properly adjusted, nor would he be able to anticipate the varying conditions of service, so that it would be impossible for him to realize anything like the results as shown in these curves.

As a further illustration of the fact that the thermal efficiency, when observed, reflects with exactness the consumption of gasoline per horsepower, or per car mile, as the case may be, reference may be had to Fig. 6, which is also one of the curves plotted under the direction of Professor Carpenter at Sibley College. In this case, the delivered horsepower is represented

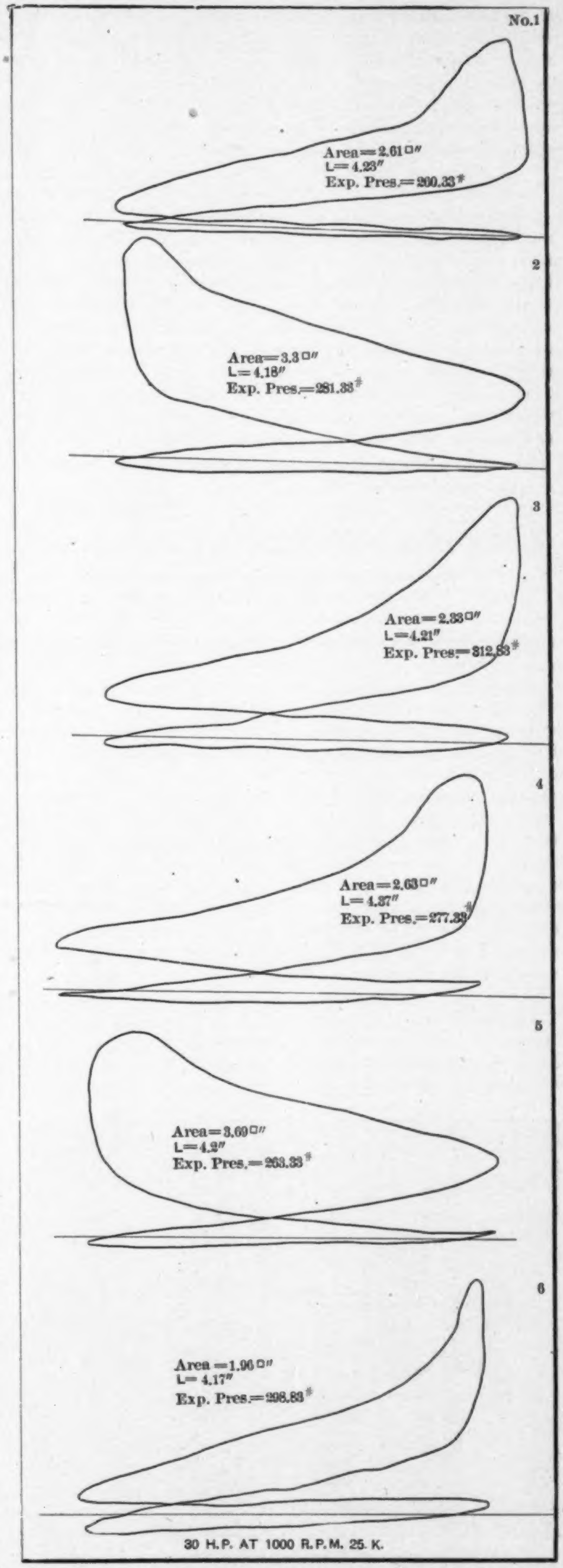


Fig. 7—Six indicator cards taken from a 6-cylinder motor showing changes in expansion due partly to poor carburetion

by ordinates, and the gasoline consumption in pounds is stated at abscissa. The motor was run at 1000 revolutions per minute, and two curves were plotted. The curve representing pounds of gasoline per delivered horsepower (D.H.P.) shows that the most economical consumption was when the motor was delivering about 35 horsepower, and the most extravagant consumption was when the motor was delivering 10 horsepower.

Lack of Uniformity Partly Due to Carburetion

It will be understood that a motor with a plurality of cylinders will not deliver a fixed amount of power, the same in each, unless the means for carburetion are such as to supply to each of the respective cylinders an exact measure of a given quality of mixture. That carbureters do fail in this important particular is readily shown by referring to Fig. 7, which represents indicator cards taken from the six cylinders of a motor. The carbureter is not entirely at fault for the variations here noted, but that carburetion represents the greatest measure of the total trouble there is no gainsaying. At all events, in this case, the expansion pressure was found to be as follows:

EXPANSION PRESSURE IN THE RESPECTIVE CYLINDERS

Expansion Pressure in pounds per sq. inch	Cylinder Number
260.33	1
281.33	2
312.83	3
277.33	4
263.33	5
298.83	6

With such wide variations in the expansion pressure, it is impossible to expect that each of the cylinders will deliver its quota of power on a basis of equality. Under such conditions, it is impossible to say that a six-cylinder motor, for illustration, will deliver as much power as six single cylinder motors of the same size, operating under substantially the same conditions. If this is not true, then it stands to reason that there is a dis advantage attached to having a plurality of cylinders, so that granting the desirability of employing four or six cylinders in a motor, it is equal to saying that the conditions of carburetion must be maintained on a basis that will assure to each of the cylinders its fair measure of the total mixture. This phase of the problem, while it has been recognized as one to be coped with by the makers who are equipped to observe the facts, is nevertheless far from sufficiently treated for the reason that it has been found difficult to so design carbureters that they would respond to the demand.

The Rayfield Principle Offers Serious Possibilities

In the Rayfield carbureter, as manufactured by Findeisen & Kropf, Chicago, Ill., the principle involved takes into account two important considerations, one of which is that the amount

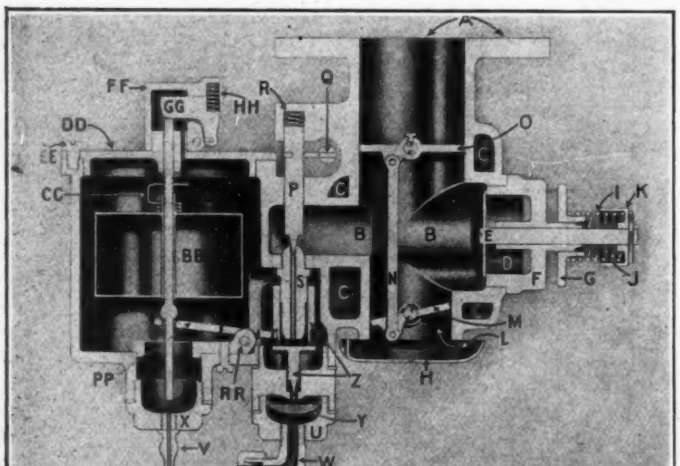


Fig. 9—Cross section of the Rayfield Carbureter bringing out the advantages of a differential compensating valve in conjunction with hand-control

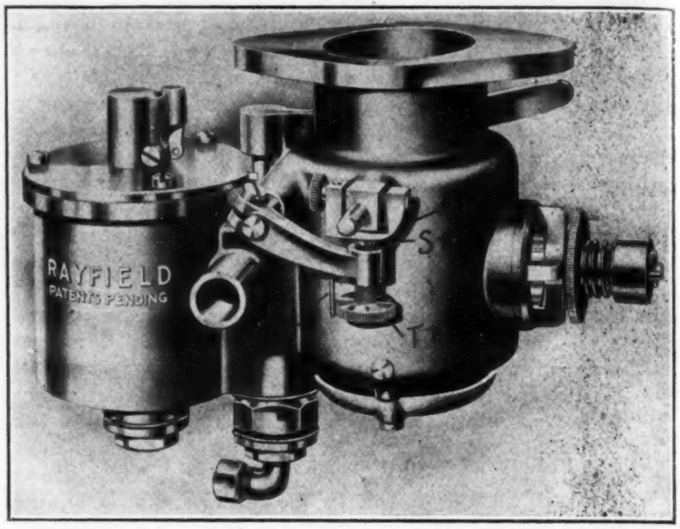


Fig. 8—Exterior view of the Rayfield Carbureter showing the method of adjusting to obtain the best result

of fuel required must be varied, depending upon the speed and power of the motor, and the remaining feature lies in the use of an automatic air valve that will operate for the purpose of supplying air when hand-control fails. The exterior appearance of this carbureter is shown in Fig. 8. It is of the float-feed type, compact in form, and of pleasing appearance, mechanically designed on a stable basis, so that adjustments when once made will remain so.

To understand the working of this carbureter, it will be necessary to examine the section Fig. 9, while following the description as follows:

Gasoline enters through the fitting W, and its mate U is filtered by the screen Y, and is stopped off by the needle Z, which has a German silver tip, engaging a suitably contrived seat. To stop the flow of gasoline, the float BB in the chamber AA, if properly set by the adjusting spring CC, will raise high enough to free the lever arm PP, thus permitting the part Z, to which the tip of the needle is fastened, to fall by its own weight so that the needle will seat. The nozzle S is concentric with the dashpot-like member Z, and the gasoline is stopped off by the auxiliary needle P, which is pressed to its seat by a spring R, but is lifted off its seat by a bell crank Q, which is controlled through a cam motion, operating when the damper O travels a certain distance. Simultaneously with the damper O the damper M travels, being actuated by the link N, and as these dampers open air is admitted through the space L above the rim of the catch-basin H, filling the cavity B. In starting the motor, a small amount of air passes in through a fixed opening, which is shown by a dotted line surrounding the nozzle S. This air sucks up enough gasoline to make a rich mixture, and this mixture passes into the chamber B, and through a slit in the damper O. The operator, desiring to speed up the motor, alters the adjustment of the damper O, simultaneously lifting the auxiliary needle T and the damper M. The result is a supply of mechanically established mixture, which, under ordinary conditions will suffice for the purpose, and to this extent the carbureter is in accord with the best practice from the point of view of mechanically controlled carbureters of the auxiliary air type.

If, for any cause, the mixture becomes unbalanced, the differential compensating valve E, which is under the control of the spring I, holding the valve to its seat, being supported at one end by the cap K, with means for adjusting its tension by way of a threaded member G, the valve E will open and supply the requisite quantity of undiluted air to bring about a readjustment of the gasoline ration in the mixture, so that if the mechanical adjustment is such that the mixture is too rich, provided the speed of the motor is increasing, the valve will open and permit of the introduction of enough air to render

the mixture sufficiently lean to do the most efficacious work. But should the mixture be too lean, the speed of the motor will decrease, in which event the differential compensating valve will close automatically, and by doing so bring about a condition of enriching of the mixture, with the result that the speed of the motor will become stable, and the power will be that which should obtain when the mixture is exactly right in view of all the operating conditions.

The secret of success of this carbureter lies in the fact that the operator is permitted to exercise his ingenuity to the extent of his ability in nursing the carburetion in response to the indicated motor and road conditions, but should the conditions alter at a rate greater than the ability of the operator to cope with them, the differential compensating valve instantly supplies the missing quantity, either diluting the rich mixture, if the speed increases, or stopping off the air supply if the speed decreases.

The remaining details are purely constructive, and unimportant from the point of this story. It will be observed, however, that the adjustment CC represents a simple and stable means by which it is possible to raise and lower the float level, if the occasion arises. As a further mechanical refinement, the bell crank GG depresses the float BB by pressing on the end of the float stem if it is necessary to time the motor in starting. The bell crank GG, however, is prevented from working excepting at will by the spring HH, which is sunk in a cavity in the metal. The housing FF covers over the mechanism so that when the car is being washed, or during inclement weather, water is not permitted to seep through and contaminate the gasoline.

In the operation of the carbureter there is only one adjustment to make, and that is for low speed. This undertaking is much simplified through the use of a thumb nut T1, the screw end of which, S1, bears against the face of the cam C1 in Fig. 8.

A means for locking, L1, maintains the adjustment of the thumb nut after it is made, and it is this adjustment that fixes the flow of gasoline in accord with the low speed requirement. At all other speeds, the rate of flow of gasoline is maintained by movement of the auxiliary needle P, Fig. 9, and a skilled operator, if he cares to do so, may then take advantage of the presence of the differential compensating valve, adjusting it with a view to further refinement in the range of performance of the motor.

Don't

STILL ANOTHER INSTALLMENT OF SHORT-METER ADVICE TO THE TYRO—AND THE EXPERT—THE FOLLOWING OF WHICH MAY SAVE THE MOTORIST HEAPS OF TROUBLE, PERHAPS SOME MONEY, AND PROBABLY A LAWSUIT OR TWO

Don't think that it is possible to blow up tires sufficiently to compensate for the lack of size that should be used on your car. If the tires are not big enough for the work they are placed to do it is not possible to inflate them sufficiently to prevent excess flexure.

Don't get used to thinking that fabric as it is used in the making of tires is some supernatural material that will stand all sorts of abuse—it costs money and plenty of it to indulge in such a dream.

Don't forget that flexure is the bane of tires—anything that will eliminate flexure is worth its weight in gold.

Don't forget that a power pump is far more likely to afford the requisite pressure for purposes of inflating tires than when a small hand pump is employed.

Don't run on a flat tire just because it is something of a job to make a road-side repair—10 miles of flat running will foot up to the price of a tube and a casing; even a single block may be a sufficient distance to bruise the fabric beyond repair.

Don't wait for the ball bearings in the hubs of the road wheels to go to pieces before taking the hub-caps off and determining as to the prevailing condition. If the bearings are flushed out once a month and new grease is applied the cost of maintenance will be relatively very low.

Don't let the repairman tell you that he is going to burn off all the old finish and refinish from the ground up, and then let him get away with a retouching job instead—a little superintendence once in a while does no harm.

Don't let water accumulate in the fuel system. Drain out all the liquid, say, once a week, and start with a new gasoline supply.

Don't demand the last ounce of power from your motor; it will last longer if it is worked under average conditions.

Don't feed gasoline too fast; carbon accumulations will then be deferred, if, indeed, they ever appear.

Don't expect gasoline to feed through a pipe that is plugged up with solder—it is a form of trouble that is too common.

Don't fill the radiator to overflow. When the water heats up it swells and a little "expansion" room is desirable.

Don't scoop dirty waer from a pool to use in the radiator. Scale, when it forms, is extremely difficult to remove.

Don't tolerate leaky joints in the cooling system. There is nothing that is more unsightly. The water has to be replaced and the chances of trouble from incrustation are very materially increased when the water has to be renewed frequently.

Don't let the hose connections of the water piping become sloppy. Just as soon as they show that they have done all the good work that may be expected of them, replace them with new sections; the cost is but a trifle—this plan will save a bad half-hour on the road some dark night when it is raining.

Don't follow up a street car on a rainy day. Traction is not then as good as it ought to be, and if the car comes to a sudden stop your automobile is likely to "enjoy" a rear-end collision.

Don't tread the car tracks if it can be avoided; the rails are usually frayed out in places, and the knife-edges are likely to cut the tread on the tire casing.

Don't neglect the air valves of the tires. The "sneaking" leak that follows neglect of this character is at great cost. Tires that are not kept properly inflated soon give out.

Don't fail to examine the rear axle and note if the bob-stays are held firmly in the saddles provided for them. Sometimes the stays jump out of the saddles and unless they are promptly replaced the axles will sag due to lack of support.

Don't neglect to examine the front axle and wheels at frequent intervals. If the wheels are not in good alignment the chances of steering trouble will be very great. It is even a good idea to so set the front wheels that they will toe in slightly; at any rate they should not toe out.

Don't fail to take up the slack of the side-chains as often as may be required; in performing this operation be sure and maintain the alignment of the rear axle.

Don't try to run the side-chains too tight; they should be given about one-half a link length of slack.

Don't neglect to keep the side-chains well lubricated. Lubricant protects the joints from the abrasive influence of sand and other road-side accumulations.

Don't be careless when washing the car; water may find its way into the carbureter; the ball bearings in the road wheels may also be given a water bath—what they need is oil, not water.

Letters

ANSWERS TO INQUIRIES WHICH WILL THROW SOME LIGHT ON THE RELATIVE MERITS OF RIGHT- AND LEFT-HAND STEERING; POWER CONSUMPTION OF ELECTRIC VEHICLES; THE BEST METHOD OF NEGOTIATING "THANK-YE-MA'AMS," SWEATING OF CARBURETERS, ETC.

Both Cylinders Do Not Act Alike

Editor THE AUTOMOBILE:

[2,336]—I am very much interested in your valuable journal, and particularly like the two pages devoted to letters and queries from your readers. I have been driving a bus for two summers and never before noticed that the exhaust from cylinder No. 1 sounded louder than that of the rear (the engine being of the 2-cylinder opposed type). Will you kindly tell me what could cause such a thing?

Quogue, N. Y. JOSEPH P. PAYNE.

The probabilities are that the rear cylinder is more or less flooded with lubricating oil. If the lubrication is all right, then the compression in the rear cylinder is not the same as that in the front. When both cylinders are working equally well from the point of view of compression and lubrication the trouble you complain of will disappear.

Autoist Relates an Unfortunate Experience

Editor THE AUTOMOBILE:

[2 337]—A few days since I crushed a Hyatt bearing on my driving shaft in such a way as to completely lock the rear system. The question which puzzled me was how to be towed to the nearest garage. My axletrees are provided with feather keys, for the purpose of fixation of the wheels to the same; these I removed after taking off the rear wheels, when we had no difficulty in being towed the same as any ordinary wagon. Any one having similar experience will do well to bear this item in mind, providing their car is similarly constructed. We had some trouble with the left-hand nut running off, so removed it entirely and fitted several leather washers to the spindle, or axletree, fastening them on with an improvised linch pin made of a common nail inserted in cotter pin hole. Any port in a storm must be the motto with an automobilist.

Troy, N. Y. J. H. BISSELL.

Autoist Wants to Know About Several Things

Editor THE AUTOMOBILE:

[2,338]—Please answer the following questions in your "Letters Interesting, Answered and Discussed" column:

1. What is the proper way to line up the wheels on an automobile so as to be sure they are in perfect alignment? I saw this answered about a year ago in THE AUTOMOBILE.

2. I have a car which is equipped with a non-vibrating coil; why is it that it will not start on the spark?

3. Why do I always have to whirl the engine to get it started, excepting after it is warmed up good and I make only a short stop, then it often starts on the quarter turn?

4. Quite often as I change gears from intermediate to high, as I let the clutch in (however easy), there is a fairly strong click as if there was lost motion somewhere. This is a new machine and did not do this until lately.

5. A friend of mine has a Remy magneto on his car and with all the spark advance he can give it, on either magneto or battery, it affects the speed of the engine but very little. Will be glad to see the above questions answered in THE AUTOMOBILE.

Minerva, Ohio. C. STOCKMAN.

1. The front wheels should toe in, each an equal amount, say, one-half of 1 degree. When the front wheels do toe in, skidding is less likely to occur, and steering is much easier and more certain. The amount of this toeing should not be enough to bring on acute tire trouble, nor will it, unless both wheels toe in very perceptibly. If the wheels do not toe in at all, skidding from other causes will be more damaging to tires than in the case of the toeing wheels, and the chances of damage from skidding will be far greater. A simple way to ascertain if the wheels are parallel is to measure the distance from felloe to felloe at the front and back of both the front and rear wheels. When the distance between felloe faces are the same at the front as at the rear the wheels are necessarily parallel. When fixing the distances for the front wheels, if it is desired to have them toe in, then the measurement between the faces of the felloes at the front of the axle should be slightly less than the measurement between the faces at the rear of the axle. There are, of course, other ways of arriving at parallelism of the wheels, but they are no more certain, having the disadvantage, moreover, of increasing the chances of error because the number of operations is increased.

2. The reason why your non-vibrating coil will not permit you to start on the spark is because you have no means available to produce the spark with the coil as described.

3. It is not unusual to have difficulty in starting a motor when it is cold, in which event it is necessary to spin the crank. A good ignition system is a long step in the right direction. Strong batteries will also help you out.

4. The click may be due to lack of clearance of some of the parts. Examine the mechanism closely and see if there is not a rubbing spot somewhere. If the click is due to lost motion, as an ill-fitting key, you will have serious trouble to cope with soon. The wise plan is to go to work.

5. This question cannot be answered with certainty because the information afforded is insufficient. By way of a remedy it will be necessary (a) to provide a battery that is in good working order, and that will deliver at least 6 volts on closed circuit; (b) good spark plugs must be utilized. Beyond the points as above stated it will be desirable to see that the compression is high enough in each of the cylinders, and it will be also necessary to look after the timing of the motor. When all these matters are properly cared for it will be time to suspect the magneto if the results are not satisfactory.

Largely a Matter of Personal Taste

Editor THE AUTOMOBILE:

[2,339]—Please advise me regarding the advantages in placing the steering wheel on the left or right-hand side of a motor.

Detroit, Mich. J. H. T.

It is something of an advantage in fore-door types of torpedo bodies, and for that matter with all touring cars, to be able to enter the front seat from both sides. If the steering wheel is on the left side, the side levers will come in the middle of the car and access may then be had to the right seat as freely as to the left. This advantage is entirely wiped out under ordinary conditions, due to the fact that spare tires are placed opposite the right entrance. The question as to whether or not a driver can do better work if he sits on the left-hand side of the car depends upon his previous practice. If he has overcome the difficulties involved in right-hand steering, there is nothing more to be said.

Worm Gear Is There for Purposes of Adjustment

Editor THE AUTOMOBILE:

[2,340]—In the July 7 issue of THE AUTOMOBILE there is a cut of the Owen differential. Is the little worm gear shown for adjusting the bearings? If not, what is its utility?

Allegheny, Pa. M. F.

Data of the Tests Must Be Examined

Editor The Automobile:

[2,341]—I am in receipt of a circular dealing with the power consumption of electric vehicles. In this circular they endeavor to make comparisons between different vehicles and they work out an expression for efficiency which takes the following form: "It takes 96 watts per carriage mile for a vehicle with two people on fair macadam. If a heavier battery is put in, it requires 123 watts per carriage mile." The conclusion is therefore drawn that the second vehicle is less efficient than the first. Inasmuch as the velocity of the two vehicles is not mentioned in any way, I fail to understand how these figures are in any way a legitimate comparison, and, as a subscriber to your valued publication, I would greatly appreciate an explanation from you which would clear my comprehension of this matter.

Denver, Col. K.

It is not possible to either refute or approve a test, if only the results are stated, and the data of the test is ignored. All that is claimed might be true, and yet the value of the statement would have to be measured in the light of the detailed facts.

Wants to Know How to Mix Picric Acid in Fuel

Editor The Automobile:

[2,342]—In The Automobile issued under date of July 21 I noticed an article written by James S. Madison on the subject "Enriching of Automobile Fuel," in which he states picric acid is most frequently used. I have heard that picric acid and sal ammoniac were good for this purpose. I would be pleased to have you state how much picric acid should be added to five gallons of gasoline to give good results.

Rossville, Ind. O. A. B.

Looks Like Interference on Neutral

Editor The Automobile:

[2,343]—I would like you to give me some information through your paper regarding a "kink" in my motor which I am unable to locate. The clutch and brake are both worked by one foot pedal, and in going down hills, when I throw out the clutch the motor will stop, and when I let the clutch in just before reaching the bottom of the hill the motor will start up again and works good on the level and in going up hills. The motor also frequently stops when I throw out the clutch and set the brake in bringing the car to a stop. Any information you can give me as to the reason for this will be appreciated.

Florence, Wis. F. B. Wolf.

When you throw out the clutch you evidently throw in something else. We should think that the neutral point is insufficient. Address a communication to the company stating clearly the nature of your trouble.

Some Drivers Use the Motor for Braking

Editor The Automobile:

[2,344]—While descending long grades it is the practice of some drivers to engage the intermediate gear and close the throttle. When they approach a waterbreak and wish to further retard the car's motion they use the foot brake momentarily without releasing the clutch. Is this practice detrimental to the motor or transmission? The waterbreaks of Western Pennsylvania can be crossed with less discomfort to the passengers if taken diagonally as shown at A, but it is easier on the car than to cross them head-on as shown at B (see illustration).

Allegheny, Pa. Murry Fahnestock.

There seems to be no objection to coasting down hill with the motor engaged and a low gear thrown in, provided the hill is not so steep as to make the motor race. In the latter event, it would be desirable to assist the motor by applying the brakes sufficiently for the purpose. It is not believed there is any objection to this practice.

Carbureter Sweating and How to Remedy It

Editor The Automobile:

[2,345]—Could you tell me through "Letters" in The Automobile the reason for the sweating of a carbureter on an air-cooled car when the carbureter is placed in front of the motor, having two cylinders? I would also like you to suggest a remedy.

Woodmere, L. I. Loss of Power.

Sweating is caused when the gasoline is vaporized, due to refrigerating effect. Every liquid, when it is changed from its liquid state to a gas form, absorbs heat from its surroundings and the temperature of the surroundings is lowered. The amount of this refrigerating effect depends upon the characteristics of the liquid employed. Gasoline, for illustration, does not refrigerate nearly as much as anhydrous ammonia. The mere fact that the carbureter exterior and perhaps the intake manifold frosts up is a sign that a considerable amount of gasoline is being vaporized, perhaps too much. It might be well to readjust the carbureter with a view to starving the mixture with the hope perhaps that there will be less frosting and that the mixture will prove to be more efficacious for its purpose. The fact that there is no frosting must not be taken as an absolute sign of good working conditions, because if the liquid goes into the combustion chamber before it vaporizes it will then "crack," forming a carbon deposit over the internal surfaces and arouse trouble in consequence.

Loss of power is due to so many things that it will be impossible to put your finger upon the precise trouble without going to some pains, more or less systematically. It is to be hoped that the compression in your cylinders is good, that the carburetion is satisfactory, and that the ignition system is capable and well timed. With all these matters properly attended to, it remains for your air-cooled motor to work at a sufficiently low temperature to permit of a sufficient weight of mixture to enter the cylinders and perform useful work. If your trouble is due to overheating, loss of power may then be charged to one or more wrong conditions, as pistons that stick when they are heated, due to expansion, poor lubrication, due to the burning up of the lubricating oil, and insufficient mixture, due to the fact that the incoming mixture is rarefied by heat, and this condition may be accentuated sufficiently to result in a noticeable loss of power.

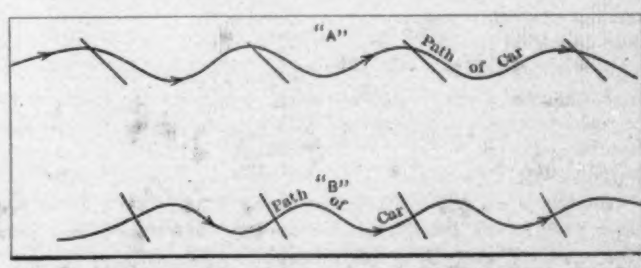
Depends Upon the Efficiency of the Steam Engine

Editor The Automobile:

[2,346]—I would like to know through your "Letters Interesting, Answered and Discussed" how many steam horsepower an automobile gasoline engine of 20 horsepower represents.

Quebec, Canada. Kanuck.

If the steam engine has a mechanical efficiency of 80 per cent. it will have to deliver 25 horsepower (indicated) in order to make the same actual delivery as that of a 20-horsepower gasoline motor. If the steam engine delivers 20 indicated horsepower it will deliver four less than a gasoline motor, or 16 horsepower. There is no difference between an actual horsepower delivered by a steam or a gasoline engine. In a steam engine the indicator does not measure the delivered horsepower; it does measure the indicated horsepower from which the mechanical losses must be taken. In a gasoline motor the delivered horsepower is measured on a dynamometer, hence the mechanical losses do not have to be taken into account to arrive at the actual delivered power.



How to take a waterbreak—A, easy on the passengers, but hard on the car; B, vice versa

Questions That Arise

FORMULAE SHOWING PROPER PROPORTIONS OF KEYS FOR SHAFTS; WHY ALUMINUM DOES NOT SOLDER READILY; SALT BATHS AND THEIR COMPOSITION

[211]—Is it not true that the proportions of keys for shafts are oftentimes wrong in that the shaft or the key is out of harmony on the assumption that the weakest link in any chain is the strongest? Why should the key be stronger than the shaft, or vice versa? What is the good of using two keys if one will do the work?

The shaft should be large enough in diameter so that when the keyway is cut the strength of the shaft should be equal to the ability of the key and the combination of the two should be equal to the work to be done with an ample factor of safety to assure that the service demanded will be rendered continuously. The formulæ as follows are intended to aid the designer to accomplish the undertaking. Let,

D = diameter of the shaft in inches;
B = breadth of the key and way in inches;
L = length of the key in inches;
T = twisting moment to be restrained in inch-pounds;
S_1 = Extreme fiber strain in the shaft due to the torsional moment;
S_2 = Extreme fiber strain in the key due to the torsional moment;

When,

$$T = \frac{\pi D^3 S_1}{16}$$

If the key is $\frac{D}{2}$ from the center of moments, then, for the key, we have:

$$T = \frac{\pi D^3 S_1}{16} = \frac{DLS_2D}{2}$$

$$\pi D^2 S_1 = 8BLS_2$$

and,

$$L = \frac{\pi D^2 S_1}{8BS}$$

[212]—Why is it that aluminum may not be soldered quite as readily as copper or other metals?

The aluminum alloys used in castings for automobile work, while they differ as to composition to a considerable extent, hold from 90 to 92 per cent. aluminum, the balance being copper, manganese, a trace of iron, etc. In attempting to solder aluminum, the first difficulty encountered is due to its low melting point. With copper it is possible to tin the surfaces when they will remain in good condition, and may be soldered by the mere application of a sufficient amount of heat at the right temperature, with no danger of damaging the copper by overheating, nor is there any tendency to oxidation. Aluminum, on the other hand, can scarcely be cleaned sufficiently to permit of "tinning," due to the fact that oxides form so rapidly that they interfere with the tinning process even though the work be done speedily. In order to solder aluminum it is necessary to heat the parts to be joined up to the melting point of solder, and after the surfaces are freed of moisture they must be cleaned by scratching with a metal brush, after which, if a suitable grade of solder is allowed to melt and run over the newly scratched surfaces, using the brush to bring about intimate contact, the solder will adhere to the surfaces, thus completing the tinning process. The solder must be made up of zinc (predominating), some tin and a small proportion of aluminum. The best way to proceed is to first bring about a condition of tinning as above indicated, using the solder high in zinc, and when the surfaces are tinned over join them together before they are allowed to cool off, thus preventing the formation of any oxide.

[213]—It is frequently stated that in quenching steel the results will vary depending upon the quenching baths, and that some baths are much more efficacious than others. What is the range of values of the respective baths?

The bath to use depends upon the results desired, and the efficacy of the respective baths may be taken as follows:

(A) Mercury.
(B) Acidulated water (ice cold).
(C) Salt water (ice cold).
(D) Salt water (normal temperature).
(E) Potable water (normal temperature).
(F) Water and skim milk.
(G) Lime water.
(H) Fish oil.
(I) Cod liver oil.
(J) Cotton seed oil.

It will be understood that mercury is too poisonous a material to utilize as a quenching bath for anything but very small pieces; even then the artisan must exercise great care. With mercury the parts to be quenched will be rendered the most hard. In the scale of hardness acidulated water comes next, then salt water, and so on down the line, finally reaching cotton seed oil which has the least ability of all the baths given from the purely hardness point of view. The oil baths, however, impart tough-hard qualities, which are frequently much to be desired as compared with the more brittle hardness due to water quenching. Sometimes it is found desirable to double quench, that is to say, quench first in oil and second in water, or have a surface of oil on the water so that the parts in being quenched contact with oil first, and finally drop into the water.

[214]—What is the particular advantage of salt heat treatment baths as compared with muffled furnaces and the open hearth? What salts are used in this class of work?

Despite the excellent control which may be had over gas furnaces, the fact remains that the temperature is not absolutely uniform at all points, and the parts to be heat treated are only uniformly heated when an expert handles the furnace. Open-hearth work is of course much more irregular than that following the use of a muffled furnace. Salt baths have the virtue of being uniform in temperature throughout, and the parts to be heated are of course raised to the temperature of the bath. The great advantage of the salt bath then lies in the perfect uniformity of the maintained temperature, and the results should be more perfect, due to this fact. The composition of the salts used in heat treatment work depends upon the temperature desired, the following being some of the mixtures that are found to be efficacious for the purpose:

SALT BATH FOR WORK UP TO 1,000 DEGREES CENTIGRADE

		Per cent.
$NaOH$,	Sodium Hydrate	8
$NaCl$,	Sodium Chloride (common salt)	91
KNO_3,	Potassium Nitrate	0.5
K_2CrO_4,	Potassium Chromate	0.5

The above compound of the available salts is designed for use at temperatures ranging between 800 and 1,000 degrees centigrade, and for lower temperatures it is possible to employ other compositions, as chloride of barium and chloride of potassium in the ratio of 3 to 2, if the maximum temperature is not to exceed 950 degrees centigrade. The low limit of this compound is 670 degrees, which is the temperature of melting of the same. The 1,000 degrees bath is more nearly universal than that of barium and potassium chlorides. By varying the proportions of the mixtures, other temperatures may be introduced. In working these salts it is necessary to employ an electric crucible.

The Pyrometer

ITS DEVELOPMENT AND USE. BEING THE FINAL INSTALLMENT OF AN ARTICLE BY WM. H. BRISTOL READ BEFORE THE SOCIETY OF AUTOMOBILE ENGINEERS AT ITS SUMMER MEETING

A PIECE of steel which is to be tested is made in cylindrical form, about 7-16 inch in diameter and 1 1-4 inches long, with a hole drilled in the end to receive the tip of the thermo couple. A vessel of water is provided for maintaining the cold end of the couple at the desired temperature. The quartz-lined furnace allows it to be brought to a high heat very promptly, and after the sample has been inserted the complete heating curve showing the absorption point will be recorded on the chart within a few minutes, after which the cooling curve can be also obtained by lifting the small sample out of the furnace and allowing it to cool.

The recording instrument is provided with a mechanical half-second vibrator so that the continuous record is made on the chart as the temperature rises and falls, even though the changes are quite rapid.

The fire end used in connection with this apparatus is made from exactly the same material as the couple which is used in the treatment of the steel from which the sample is taken, and, therefore, the practical results desired are made to depend upon the preliminary tests.

A special form of thermo-electric couple has been designed for quickly taking the temperature of molten metal. It consists of two elements of different alloys which are left disconnected at the end where the junction is usually made.

In Fig. 18 one of these couples and a portable instrument is shown, with a cross-section of the couple. One element of the couple is a tube, the other a special alloy wire with insulation between the wire and tube. When this couple is immersed in a crucible of molten metal, electric connection is made between the outside tube and the insulated wire at the end of the tube, and a reading will be obtained of the temperature of the molten metal at the tip of the thermo-electric couple.

This form of couple has been successfully used for taking the temperature of molten metals while crucibles are in the furnace.

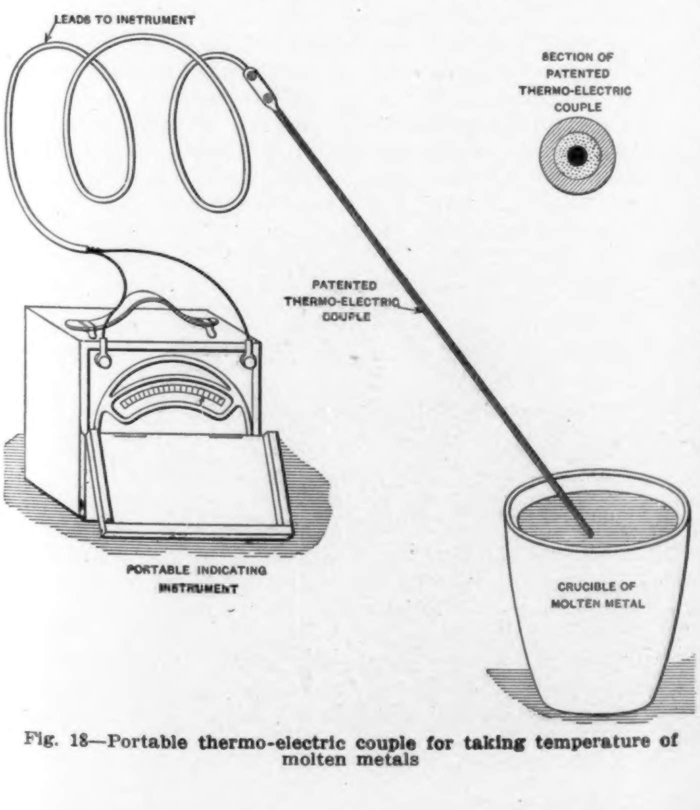


Fig. 18—Portable thermo-electric couple for taking temperature of molten metals

In the use of pyrometers for every-day shop practice, methods of checking the accuracy of the instruments are important.

The initial cost of spare fire ends is so low that extra fire ends should always be kept on hand. To be sure that the fire end which has been in service is accurate, a new one may temporarily be connected to the leads of instrument, both fire ends being placed side by side in the furnace or bath of molten metal during the test. To check the instruments an auxiliary portable pyrometer is recommended having its own set of leads and extension piece. Then the portable instrument may be connected to the fire end in service in place of the regular instrument, thus furnishing a ready means of determining its accuracy.

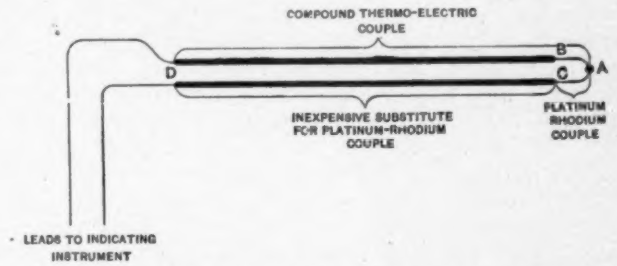


Fig. 19—Diagram showing construction of compound thermo-electric couple

The fusion points of metals also afford convenient means of checking pyrometers. Le Chatelier platinum, platinum-rhodium couples with suspension-type galvanometers are recommended for laboratory tests and for calibration.

For quick measurement of furnaces having temperatures between 2,000 and 3,000° Fahr. a modified form of the standard platinum, platinum-rhodium couple has been developed which has proved valuable in practice.

The diagram Fig. 19 illustrates the construction of the compound couple as it is called. Special alloy base metals having cross-section several times greater than the platinum elements are joined to the platinum and platinum-rhodium elements at A and B, the special alloys used being selected so that the thermo-electric effects of the juncture at A and B balance each other, and the reading on the instrument depending entirely upon the thermo-electric current produced by the junction C. The secondary junction should not be heated above 1,200° F.

The cross-section of the special alloy extensions of the platinum, platinum-rhodium couple are made of sufficient size so that the resistance will not appreciably affect the accuracy of the readings on instrument, even if made of considerable length. The tip of the platinum-rhodium couple is left exposed for about one-half inch, the remainder of the couple being inclosed in an iron protecting tube. An extra guard tube or sheath is provided with a set screw to cover the delicate platinum tip for transportation, and while inserting and while drawing fire end from furnace.

Readings of the flame temperatures of a furnace may be made with the instrument within a few seconds.

Steel Must Be Selected in View of the Duty

It is too frequently claimed that by a mere process of heat-treatment it is possible to obtain the most desirable results without selecting the grades of steel that are suited to the place and the character of the work to be done. That this is a fallacy is well appreciated by those who have studied the situation. Proper selection must not be neglected—heat-treatment is secondary.

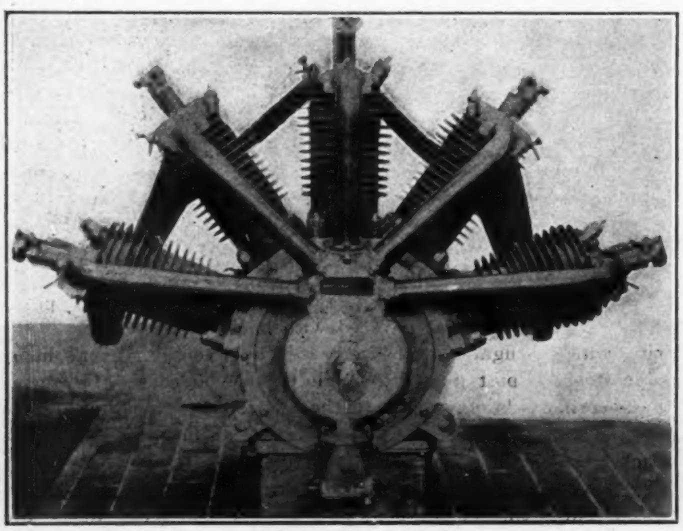
Digest

BRIEF RESUME FROM 50 FOREIGN PAPERS: GERMAN PRECAUTIONS AGAINST FIRE IN GARAGES—THE R. E. P. MOTOR—MAYBACH'S LUBRICATOR WITHOUT SPRINGS—SOME TELLING TESTS OF GNOME MOTOR

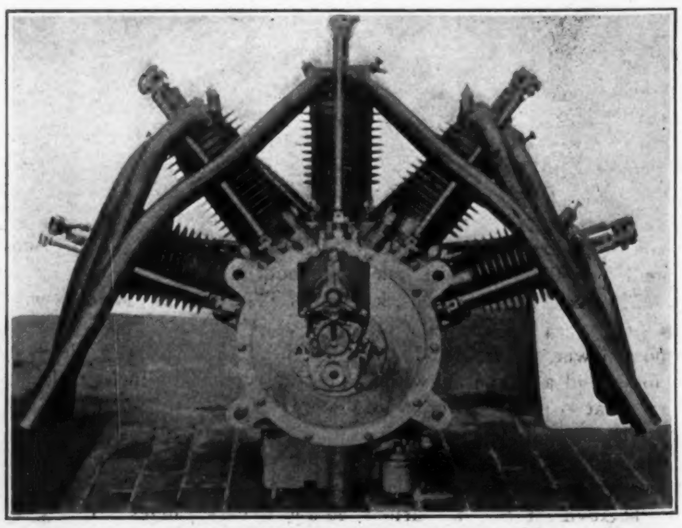
With a view to safety against fire in its garages the Berlin General Omnibus Company has for some time endeavored to develop an explosion-proof incandescent lamp plug which may be connected and disconnected by simple insertion and withdrawal (Westinghouse type). The regulations of the Association of German Electrotechnicians prescribed that no apparatus in which the breaking or making of electric contact is a normal function may be employed in any business place in which there may be danger of explosion, unless its construction has first been approved as explosion-proof. And the Omnibus Company had found that lamps suspended from movable wires to be connected up at any convenient place by insertion of a plug (not a screw plug, since this would twist the wire and the lamps suspended from it) were indispensable for the night work of cleaning, testing and repairing of automobiles regularly carried on in the company's large garages. Several plugs offered in the open trade were tried but were found either not safe enough to be approved or not substantial enough to withstand wear and tear. The connection shown in the accompanying illustration was then developed by the company's engineer, and its security consists of course in the double air space around the contact, the outer space remaining closed till the arc in the inner one disappears. It was tried officially in connection with an incandescent lamp in a box containing an explosive mixture of benzine, gas and air, and the capacity of this mixture for producing an explosion was tested at regular intervals during the test. The connecting and disconnecting was done mechanically, and after contact had been switched off and on 5370 times without causing an explosion the plug was examined and, while it showed wear at the push joint, its continued safety was considered satisfactory. The question arising whether the height of the switch above the floor of a work room did not in itself offer sufficient guarantee against explosions, on the ground of the higher specific gravity of benzine or gasoline vapor as compared with air, another test was arranged at which the underwriters and representatives of the fire department were present. Sixty liters of benzine of specific gravity 0.750 was poured out over the floor of a garage with 80 square meters of floor space and six meters height of ceiling, and all openings were closed, in so far as practicable. The temperature of the place was about 20° C. After about one-half hour, when nearly all the benzine had evaporated, samples of the air were taken at heights of 1-2, 2, 3 1-2 and 5 meters. Trials with an explosion tube failed to bring any of the samples to explosion. Quantitative analysis showed that the samples taken from the lowest stratum contained 0.9 volume-per cent. of benzine vapor. But according to Bünte a mixture of benzine vapor and air does not become explosible until the volume-per cent. of benzine vapor reaches 2.5, and ceases to be explosible when it reaches 4.8. On the basis of these trials a permit was granted to the Omnibus Company to make use of the construction here shown, provided the plugs were placed at least 1 1-2 meters above the floor.—*Zeitschrift des Mitteleuropaischen Motorwagen Vereins, ultimo* July.

Among the aviation motors whose type promises a wider application, the R. E. P., called after its designer, the young aviator-engineer-builder Robert Esnault-Pelterie, attracts attention. It develops 50 to 60 hp. with five cylinders 110 by 120 which work on a single crankpin similarly as the Italian Miller motor, one of the connecting-rods embracing the pin with a hard bronze bushing and the others working upon the knuckle of the first one, by which arrangement the piston travel is not quite alike for the five cylinders. The ignition takes place in two cylinders in the order, 2, 4, 1, 3, 5. A single valve cam disk rotated at one-fourth the speed of the crankshaft takes care of the valve movements by means of a plurality of cam formations on its grooved periphery. Each cylinder carries on its hemispherical combustion chamber two valves operated by a rocker arm controlled by tappet from the aforesaid cam disk. The intermediate shaft for the gear driving the latter drives the magneto direct, having a speed suitable for this purpose. Lubricating oil is carried to the crankpin and other connecting-rod bearings through the hollow crankshaft. The double disposal of the exhaust is shown plainly in the accompanying rear view of the motor. The carbureter has a special air intake controlled in connection with the throttle, and this intake is sheltered from sudden atmospheric variations. A five-day trial from June 16 to 21 in the testing department of the Automobile Club of France showed a consumption of fuel of 270 grammes per horsepower hour. The weight of the motor with magneto, carbureter and storage battery for auxiliary ignition amounts to 150 kilos.—*La Vie au Grand Air.*

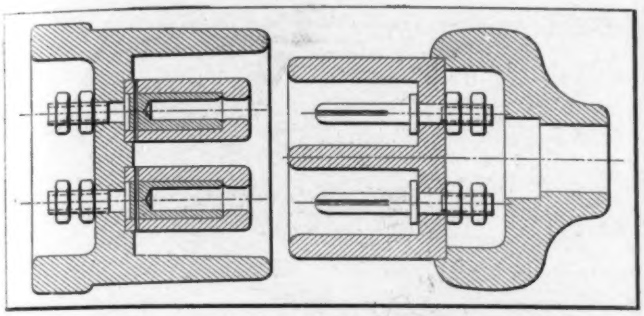
In a multiple lubricator patented by Maybach (German Daimler) visible feed, independence of temperatures and adjustability for each oil lead are features secured in a very com-



Front view of the R. E. P. aviation motor

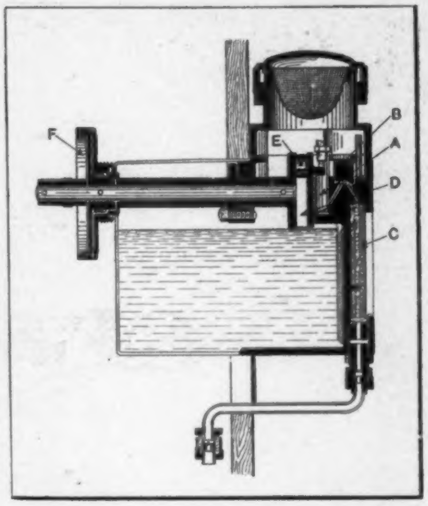


Rear view of the R. E. P. aviation motor



German safety lamp connection for garages

pact construction dispensing with springs, valves and fittings. The visibility of the feed is obtained by having the pumps for each individual oil lead send measured air bubbles alternately with oil through the glass sights. To insure equal feed, whether the oil is cold or warm, thick or thin, the distribution of oil and air from the reservoir to the pumps and from the pumps to the leads is effected by means of a sliding plate which effectively interrupts all communication between suction and pressure conduits, so that no oil can run back during either the suction stroke or the pressure stroke. In the illustration *A* represents the individual pumps, *B* the distribution slide, *C* the sights, *D* the actuating bar or ruler, *E* the driving crank and *F* the external driving pulley. The slide is shown in the position which produces a connection between pump and lead. Accordingly as it is moved, the oil and air suction conduits are alternately connected with the pumps. The bar *D* is moved to and fro by the crank *E* and at the same time up and down by means of a cam. The to-and-fro movement actuates the slide and the up-and-down movement the pumps. By a gear in the ratio of 1 to 12, taking the place of pulley *F*, the oiler may be driven from the camshaft and by variations in this ratio the general feed may be increased or reduced. To give the individual leads less oil, the adjustment nuts on each piston may be turned back, imparting a corresponding amount of lost motion to the piston.—*Zeitschrift d. Mittel. Motorwagen Vereins.*



New Maybach patent force-feed oiler

At a half-hour test of the revolving 14-cylinder Gnome motor weighing 138 kilos and rated at 100 hp. the consumption of gasoline at 1,000 r.p.m. was 5.7 kilos and of lubricating oil 4.4 kilos, hp. 76.1 and at a one-hour test at 1,100 r.p.m., 22.7 kilos gasoline and 11 kilos oil, hp. 74.4—*Bulletin Officiel.*

Lozier Announcement

THIS WELL-KNOWN MAKE OF CAR IS OFFERED FOR 1911 SUBJECT TO SUCH REFINEMENTS AS ANOTHER YEAR'S EXPERIENCE DICTATES

FOR the season of 1911 the Lozier Motor Company, of Plattsburg, N. Y., and Detroit, Mich., still retains its slogan of "The highest grade and quality of motor car possible to produce, and regardless of expense." The company will devote its energies during the coming twelvemonth to the production of two high-class cars—Types 46 and 51, high-powered four and six-cylinder models respectively. With these two chassis eight different varieties of body equipment will be furnished—Touring, Briarcliff, Lakewood and Limousine for each of the two models. The seven-passenger touring car will be practically the same as last season, except that it will be fitted with fore-doors. The Lakewood, which, by the way, was the first American stock car built with fore-doors, is a decided improvement over last year in that it has a side door which folds downward and outward, disclosing a chauffeur's seat, this affording accommodations for five passengers. There will be no change in the Briarcliff body from the 1910 lines. It is to be remembered that any style of body which can be fitted to a four-cylinder car is also applicable to the six-cylinder chassis, there being no difference in the chassis construction aside from the motor. The touring and limousine bodies in both models accommodate seven passengers; the Briarcliff and Lakewood bodies seat five.

The six-cylinder chassis, known as Type 51, has cylinders with a bore of 4 5-8 inches with a 5 1-2-inch stroke, developing 51 horsepower, A. L. A. M. rating. The four-cylinder model, denominated as Type 46, with 5 3-8-inch bore and 6-inch stroke, is rated at 46 horsepower A. L. A. M.

The six-cylinder chassis has a wheel-base length of 131 inches, that of the four-cylinder model being 124 inches; the tread on all Lozier models being 56 inches.

The weight of the various equipped cars ranges from 3,375 pounds for the Briarcliff and Lakewood fours to 4,375 pounds for the six-seated limousine.

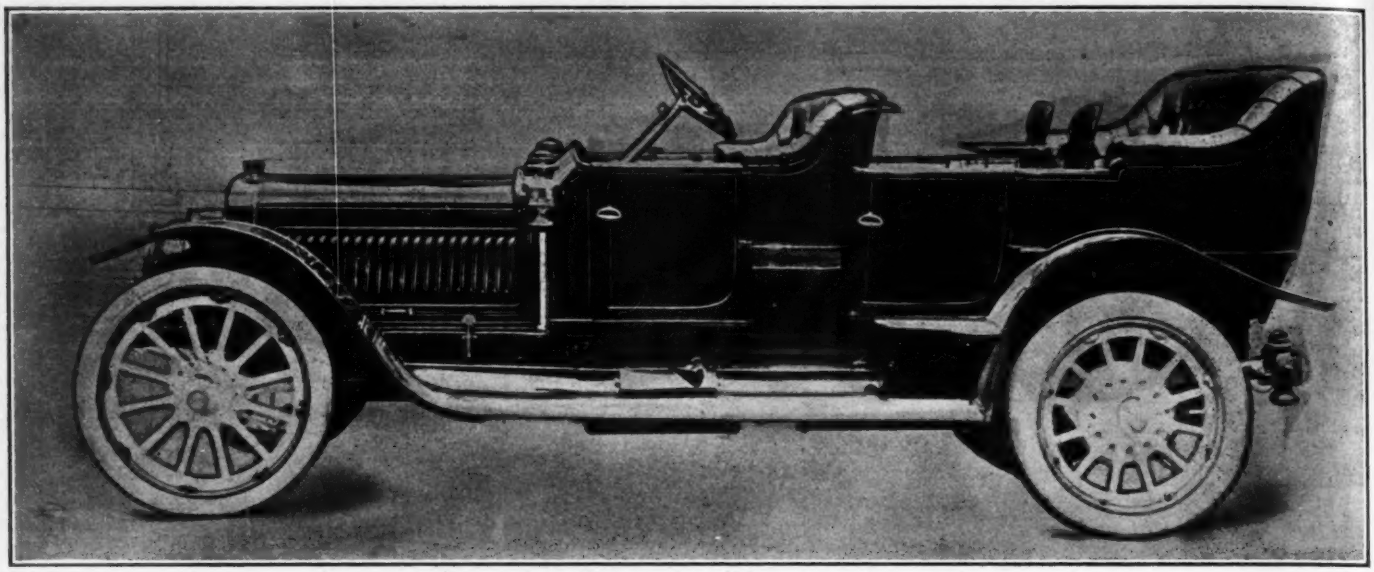
Four powerful brakes on the rear-wheel drums constitute the brake system. All movable or wearing parts of the brake system are fitted with grease cups. The emergency brake rings are of the floating type, perfectly equalizing in themselves; and in addition, brake-beam equalizers are fitted through slots in the frame. The adjustments of the braking system are worthy of note, the contracting bands being provided with winged nut adjusters, while in the emergency brake rod is inserted a turn buckle with hand-lever adjustment. Springs are of the half-elliptic front and platform rear type, all shackles being fitted with hollow pins, bronze bushed and fitted with grease cups.

Suspended under the rear of the chassis frame is the gasoline tank with a capacity of thirty gallons, and gasoline is supplied to the carbureter by an automatic pressure system. In the gasoline line is fitted a combination strainer and water separator, it being possible to remove the strainer for cleaning without removing any of the floor boards.

The frame is of alloy steel, heat treated in lead, with arched rear and extremely narrow front, giving short turning radius. The steering gear is irreversible, of the worm and toothed wheel type; and instead of using a sector the gear wheel which engages the worm forms a complete circle and new faces may be presented to the worm in case of wear.

The steering wheel consists of a cast aluminum rim, spokes and hub, the rim being covered with hard rubber, cast over the rim, with corrugations to give a firm hold to the driver's hand. The steering post passes through the toe-board in an annular ball-bearing, adding greatly to the easy steering qualities of the car. The cross link of the steering mechanism is positioned back of the front axle, while the drag link is above the front axle instead of below it as heretofore.

The entire underbody of the car is protected from injury and road drift by a continuous casing of cast aluminum alloy, and while the clutch is protected from road drift and dirt by being encased in a dust-proof metallic case, the cast-aluminum fly-



Six-cylinder 51-horsepower fore-door type Lozier touring car with a long hood, straight lines, wide entrances, and clean running-board

wheel pan assists in keeping the power plant clean and free from mud or dust.

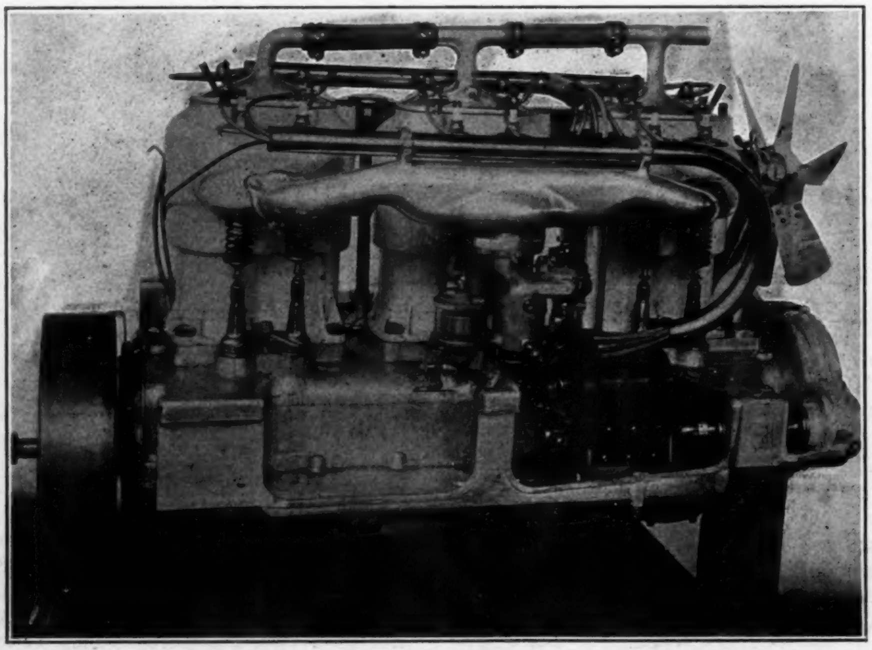
Road wheels are 36 inches in diameter, the front being equipped with 4-inch tires, the rear with 5-inch tires. All models are regularly fitted with Continental demountable rims. The front wheels are now fitted with adjustable cup and cone ball-bearings instead of bearings of the annular type.

Notable Changes Made in the Cars

Perhaps the most notable change in motor construction lies in the adoption of the long stroke. The cylinders are cast in pairs, T-head type, and finished in pearl gray by an enameled process with a final baking. The water-piping, intake pipe, fan standards and other small parts are cast from aluminum and given a polish. The motor valves are of high nickel steel with integral heads, and it is worthy of note that the fillets at the joints of heads and stems are large, so that the heat picked up by the heads is quickly transmitted over the whole length and warping is prevented. The valves are larger in size than they were in last year's cars, and valve guides are inserted in the cylinders, making it possible to renew them should they become warm without having to renew the whole cylinder. The valve covers of both the models are screwed into the heads. The pistons and rings are given a final grinding and are brought to gauge. The reciprocating parts are balanced. The hollow wrist pin is made of tool-steel and is prevented from floating out by two set screws near the ends, and they in turn are prevented from backing out by a wire lock between the heads of the two screws. As in former years, the crankshaft is mounted on annular type ball bearings; even the camshafts rotate on ball bearings of the annular type, and this type of bearing is extended to include the rotative parts of the magneto, pump shaft, fan, clutch, leaving no bearings to the tender mercies of chance or the exigencies of hard service.

SPECIFICATIONS FOR LOZIER

MODELS	Price	H.P., A.L.A.M.	BODY		MOTOR				COOLING		IGNITION		Lubrication
			Type	Seats	Cyl.	Bore	Stroke	Cyl. Cast	Radiator	Pump	Magneto	Battery	
51	$5500	51.6	Tour'g.	7	6	4[illegible]	$5\frac{1}{2}$	Pairs	H'comb.	Pump	Bosch	Storage	Splash.
51	5500	51.6	B'cliff	5	6	4[illegible]	$5\frac{1}{2}$	Pairs	H'comb.	Pump	Bosch	Storage	Splash.
51	5500	51.6	L'wood.	5	6	4[illegible]	$5\frac{1}{2}$	Pairs	H'comb.	Pump	Bosch	Storage	Splash.
51	7000	51.6	Limous.	7	6	4[illegible]	$5\frac{1}{2}$	Pairs	H'comb.	Pump	Bosch	Storage	Splash.
46	4600	46	Tour'g.	7	4	5[illegible]	6	Pairs	H'comb.	Pump	Bosch	Storage	Splash.
46	4600	46	B'cliff	5	4	5[illegible]	6	Pairs	H'comb.	Pump	Bosch	Storage	Splash.
46	4600	46	L'wood.	5	4	5[illegible]	6	Pairs	H'comb.	Pump	Bosch	Storage	Splash.
46	6000	46	Limous.	7	4	5[illegible]	6	Pairs	H'comb.	Pump	Bosch	Storage	Splash.



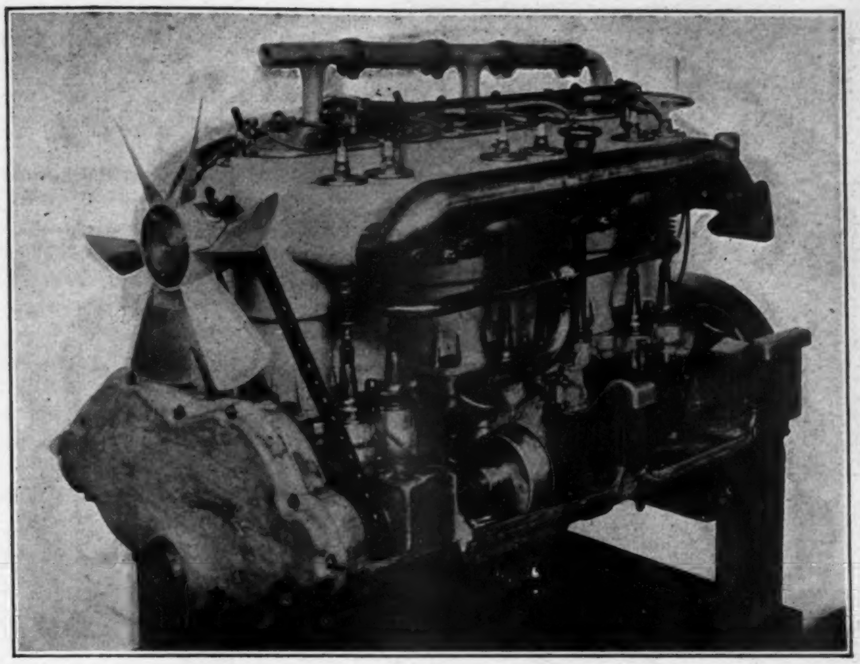
Right side of the Lozier six-cylinder 51-horsepower motor, presenting the Stromberg carbureter, magneto, and method of driving

The ignition system remains as before. It consists of two separate methods, including a Bosch high-tension magneto and a storage battery of large capacity, working in conjunction with a coil and distributor, with two independent sets of spark plugs.

Lubrication is by splash. A gear-driven pump supplies the oil to the motor, an auxiliary oil tank is placed on the chassis and a hand-pump is connected therewith through the good office of which lubricant may be supplied to the bearings needing it at the

will of the operator. The clutch is of the multiple disc type, as in last year's car; it is made up of 31 steel discs in an oil-tight, dust-proof flywheel housing. The driving discs are mounted on annular ball bearings. A clutch retarding brake is utilized for the purpose of overcoming inertia, thus rendering the gear shifting operation simple and preventing disastrous clashing.

The transmission is of the 4-speed, selective sliding type, with an aluminum box in one piece, provided with a cover. This is a departure from the usual practice of halving the box, and it is claimed for this construction that oil leakage is eliminated. The direct drive is on third speed, as in former Lozier cars. The ratio is about 3 to 1, it being the idea that in autoing it is practicable to run on the third speed for most of the time. Using this speed direct assures a certain silence of performance and reduces the necessity of listening to the hum of gears nearly all the time.



Left side of Lozier "six" motor, showing water pump connections, and fan drive

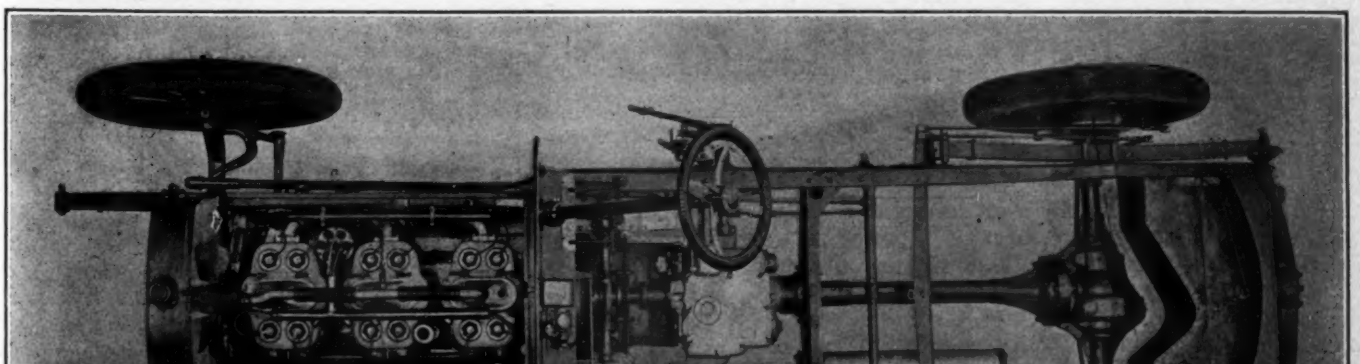
CARS AS OFFERED FOR 1911

Clutch	TRANSMISSION				Wheelbase	Tread	Frame	BEARINGS			Weight	TIRES	
	Type	Speeds	Location	Drive				Crankshaft	Trans-mis'n	Axle		Front	Rear
Disc.....	Selecti'e.	4	Frame.	Shaft...	131	56	Al. Steel	Ball....	Ball....	Ball....	3,655	36x4	36x5
Disc.....	Selecti'e.	4	Frame.	Shaft...	131	56	Al. Steel	Ball....	Ball....	Ball....	3,450	36x4	36x5
Disc.....	Selecti'e.	4	Frame.	Shaft...	131	56	Al. Steel	Ball....	Ball....	Ball....	3,450	36x4	36x5
Disc.....	Selecti'e.	4	Frame.	Shaft...	131	56	Al. Steel	Ball....	Ball....	Ball....	4,375	36x4	36x5
Disc.....	Selecti'e.	4	Frame.	Shaft...	124	56	Al. Steel	Ball....	Ball....	Ball....	3,580	36x4	36x5
Disc.....	Selecti'e.	4	Frame.	Shaft...	124	56	Al. Steel	Ball....	Ball....	Ball....	3,375	36x4	36x5
Disc.....	Selecti'e.	4	Frame..	Shaft...	124	56	Al. Steel	Ball....	Ball....	Ball....	3,375	36x4	36x5
Disc.....	Selecti'e.	4	Frame.	Shaft...	124	56	Al. Steel	Ball....	Ball....	Ball....	4,300	36x4	36x5

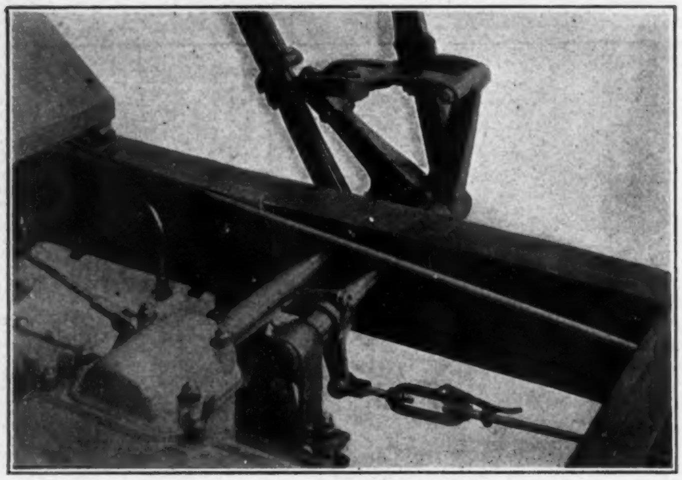
The final drive is by a cardan shaft of the full floating type without universal joints, although the forward end of the shaft terminates in a universally held member related to a substantial cross bar fastened in the two members of the chassis frame, there being a large ball-shaped housing with ample bearing surface to take the shock and do the work.

This construction eliminates the need of a torsion rod, the torsion function being performed by a tubular housing, of nickel steel, bolted rigidly to the differential case of the live rear axle with its extremity composed of a telescopic joint as before mentioned. The live axle is so designed as to be readily withdrawn, and by unbolting the two straps holding the differential in place the entire differential and main gear may be removed. Both of the main drive bevels are mounted on ball bearings, the drive shaft bevel being supported on the floating end by a ball bearing, as well as at the forward end, and both bevels are provided in addition with adjustable thrust bearings.

A change has been made in the radius rod, which, instead of terminating in ball and socket members, is designed to encircle the rear axle at the rear end, while the forward end terminates in a bronze bushed eye and is held by a pin of liberal dimensions. The radius rods are made from D-shaped drop forgings. The spring perches are free to turn on the rear axle tubes, it being the idea to induce flexibility, which quality is also added to through the good properties of the telescopic joint at the forward end of the propeller shaft housing.



Chassis plan of the six-cylinder 51-horsepower car indicating the r elations of units and method employed for obtaining clearance for the gasoline tank in the rear



Part of the Lozier side-frame at the point of fastening of the quadrant for the side-levers

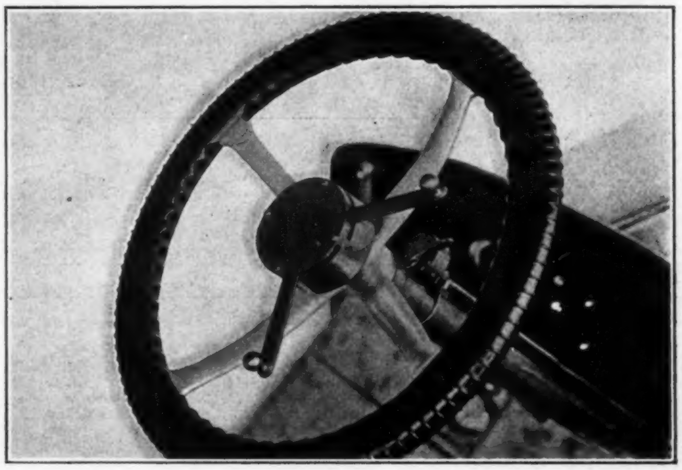
Among the improvements to be noted in the motor is a compression release on the exhaust valves. The starting-handle axle is enclosed in an oil-tight housing, excluding the entrance of dust, and when the handle is let go after starting the motor it is so contrived as to remain in the upright position, nor is there an external latch or strap employed. The magneto and carbureter are located on the right side of the motor, the latter being of the Stromberg type. The magneto is driven by an extension shaft out of the half-time gear housing, the pinion of which meshes with the train; the magneto is flexibly mounted, the universal joint for the same coming just back of the right fore arm of the motor case. The left side of the motor holds the water pump, makes room for a well contrived exhaust manifold, with the water piping just beneath, and the fan is driven by a belt which passes around a driving pulley, the latter being on a shaft which is driven by a pinion located relatively the same as the magneto drive. The motor is supported by three arms, and instead of an underpan, the aluminum case is flanged out between the arms and is faced to snug up against the underflange of the chassis frame.

An examination of the chassis will disclose a nice relation of the units with means for ready assembling, and among the other features of distinctly Lozier characteristics is the idea of the independent placing of the emergency brake mechanism so that the ills of torsion do not interfere with the sliding mechanism. The gasoline tank is placed back of the rear axle high up to afford the proper ground clearance, and it is so shaped that the differential housing clears, but the capacity of the tank is increased, due to the advantage taken by fixing a constant clearance line following the contour of the axle.

The regular Lozier equipment includes trunk rack, robe rail, foot rest, horn, brass tire-holders, tool box with complete set of tools, Prest-o-Lite tank, two gas headlights, dash lamps and tail lamp, the latter being a combination of oil and electric. The battery has extra large amperage calculated to furnish ample current for motor, lamps, Klaxon horn, speedometer, etc.

As to price, all the models of Type 51 are listed at $5,500, with the exception of the limousine, which is quoted at $7,000. The latter style in Type 46 is catalogued at $6,000, the other three styles at $4,600.

Upon the completion of the magnificent Lozier plant at Detroit no more complete cars will be built at the company's Plattsburg factory; that plant will thenceforth turn out castings,



Lozier steering equipment, showing a large diameter fluted grip on the wheel, stout post, with secure anchorage at the foot-board

gears, machine screw parts and other supplies for the new works at Detroit. Two large additions have recently been put up at Plattsburg, and the plant there will continue to be operated to the fullest extent.

Ideal Electric Vehicle

MECHANICAL AND ELECTRICAL FEATURES OF THE IDEAL, SHOWING THE RELATIONS OF THE COMPONENT UNITS AND METHOD OF CONNECTING UP THE ELECTRICAL SYSTEM

LONG-continued effort in the electrical field of endeavor has brought most of the equipment down to a standard basis, but there is still a chance for the individual to exercise his ingenuity. The Ideal Electric Company, of Chicago, Ill., having in mind certain requirements for vehicles in this class, entered the field with the intention of supplying the obvious needs. The appearance of the car is shown in Fig. 1, which, in a general way, may be set down as a town car with inside control, side-chain drive, using an individual motor and a silent chain for the primary reduction. The chassis is so contrived that the battery is properly housed in two sections; one at the front, and the other at the back end, bringing the weight over the springs and so distributing it that the riding qualities of the car are very good. The center of gravity is low and the road performance notable.

The motor is shown in Fig. 2; it is of the Westinghouse vehicle type, fully enclosed, and is flexibly mounted upon the jackshaft J1, using bearings B1 and B2. The support to the side-frame S1 at one end has a liberally proportioned flange F1, and the silent-chain drive S2 is clearly shown at the point where the cover is removed from the housing for the same. The differential gear is in the same housing at the enlargement E1 and the point of fastening or flanging to the remaining side-frame comes at F2. The driving sprockets are pressed on the ends of the jackshafts at S3 and S4. The wiring for the motor is secured to suitable terminals at W1, and the arrangement is such that the wiring conforms to the diagram of the same as depicted in Fig. 3.

One of the Matters of Recognized Importance

In electric vehicle work it is almost impossible to keep acid fumes out of contact with the wiring system, and in order to avoid the resulting difficulties it was deemed expedient in this car to run the wiring system in such a way as to have it accessible for repair, but at the same time protected from acid fumes and mechanical interferences of every kind. The wiring is done ac-

cording to the plan as shown in Fig. 3, and is so arranged as to include the connections to a battery divided into two parts, one of which is marked "front battery" and the remaining subdivision is designated as "rear battery." The controller is so designed as to include four forward speeds, the "off position" and reverse. In first speed a resistance is employed, and its relation to a field shunt is shown in the wiring diagram. The equipment includes a single motor, a voltmeter V and an ampere meter A, also a bell for signaling, and the lighting is done by means of electric lamps with connections to lamp circuit as indicated. The charging receptacle connects the two halves of the battery in series, including an ampere meter, with the understanding, of course, that the voltmeter is connected in parallel to show the voltage on charge and the voltage of the battery during discharge. Beyond commenting upon the correctness of the method employed in the connecting up of the equipment used, it is worth while taking into account the fact that the company has standardized its methods, so that the artisans when they become accustomed to the work are enabled to proceed with accuracy and dispatch, thus reducing the

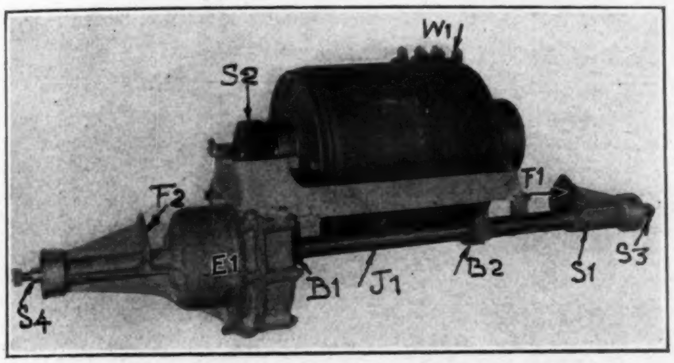


Fig. 2—Westinghouse motor with a double-reduction gear, the primary reduction being with a silent chain

cost of repairs, and what is more to the point, the time a car will be out of commission, should repair work become a necessity.

Methods of Control Carefully Looked After

The fact that electric automobiles are to be driven a considerable portion of the time by those who may be entirely devoid of mechanical training renders it necessary to so contrive the control system that it will not prove to be too complex to be readily understood. In addition to the question of the number of speeds available, it still remains to so arrange them that they will respond logically and when the power is cut off the brakes should be readily applied if it is desired to do so. In this car the control lever is placed to the left of the driver, who also sits at the left side of the seat, and there are four forward speeds arranged progressively so that pushing the lever in the forward direction throws in the four forward speeds one after the other, and pulling the lever backward has the reverse effect. If, after the lever is shifted to the zero position, it is desired to apply the brakes, all that has to be done is to pull the lever back from neutral to perform this operation. If it is desired to go into reverse, however, the lever must be shifted sidewise for a short distance and then pulled back.

The steering equipment consists of a tiller within the car located on the left side convenient to the driver, and the mechanism it actuates is simple and strong. The connecting links are of adequate strength, placed in protected positions, and all the joints are so carefully made that lost motion is kept out. The axles are of the I-section, forged in one piece from suitable grades of steel, and the remaining details are worked out in a fitting manner.

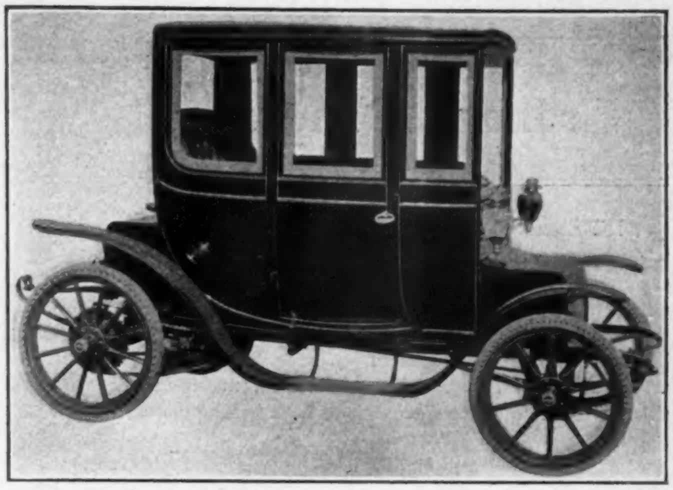


Fig. 1—Ideal Electric town car with inside control

The car is built up on a chassis frame of the I-section, of dimensions to render it wholly unnecessary to rely upon the body framing to support any of the load, and the method of bracing the side bars is that which obtains in regular practice in the construction of gasoline types of automobiles. The motor suspension is so devised that the side chains are relieved from undue strains, and alignment is brought about and maintained through the use of distance rods that are sufficiently strong to withstand the work that is likely to be put upon them in severe service.

Exide Battery is Used in the Ideal

Reliance is placed upon the Exide battery in the cars of this make, and the number of cells as well as the number of plates per cell is determined by the service to which each car is to be devoted. Preference is given ample battery equipment rather than to skimp with a view to economy of weight or to lower first cost.

In view of the general character of the service to which electric vehicles of this class are put, the greatest attention has been given to the details of the battery installation. If, in the course of events, it is found desirable to remove the battery for purposes of cleaning, it may be accomplished in the shortest possible time by the owner, or if a man is in charge of the car, it is not necessary for him to be a battery expert. All the connections are carefully identified and the method of marking is such that, in putting the battery back into the car, it can only be done in one manner and that is the right way. The work of charging the battery is much simplified, and the chances of damaging the battery are reduced to a remote contingency. The cost of maintenance of the car is held at a lower level in this way.

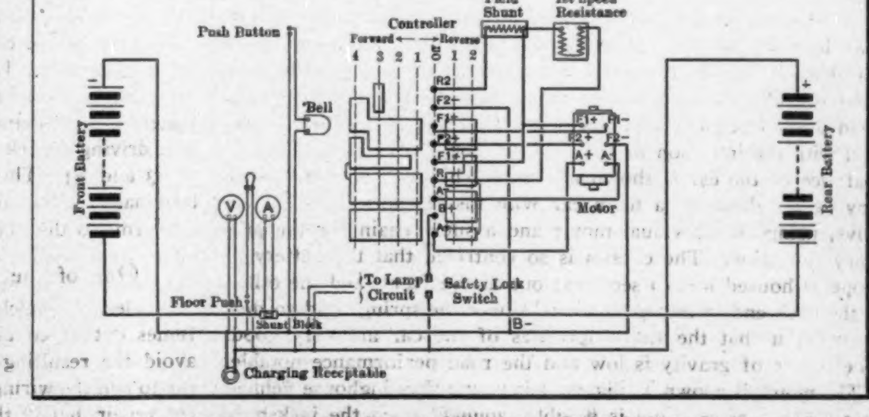


Fig. 3—Wiring diagram arranged for a unit motor and the battery in two parts, designed to give four forward and one reverse speed

Graham Differential

PRESENTING A CROSS SECTION IN TWO PLANES OF THE GRAHAM DIFFERENTIAL GEAR WHICH IS OF THE OVERHAULING TYPE. ALSO DETAILS OF DESIGN AND CONSTRUCTION

DIFFERENTIAL gears of the conventional type consist of a system of planets engaging similar suns. They are so contrived and arranged that they weigh out the torque of the motor, conforming to the conditions as follows:

(A) If the automobile is traveling straight ahead on a hard level road an equal amount of power is delivered to each traction wheel, and the differential-gear system remains inactive just as though the two wheels were attached, having an axle between them.

(B) When the automobile is turning around the corner, the differential gear permits one wheel to rotate faster than the other, but it delivers power to both wheels if the traction conditions are the same for each of them.

the conventional type of differential gear sufficient to overcome the ills as referred to in (C) involving the performance under bad road conditions, offering at the same time the facility referred to in (B) in that the automobile is permitted to go around a curve without dragging one of the wheels.

The particular axle shown in Fig. 13 was gotten up to include the use of Timken roller bearings, one of which is indicated at T1. The bevel pinion P1 meshes with the bevel gear G1 in the regular way. Briefly stated, the construction as indicated is such that when an automobile is going around a curve the outer wheel, which must travel the greatest number of revolutions, is permitted to go faster than the inner wheel, but the load is taken by the inner wheel during this period unless it enters a soft

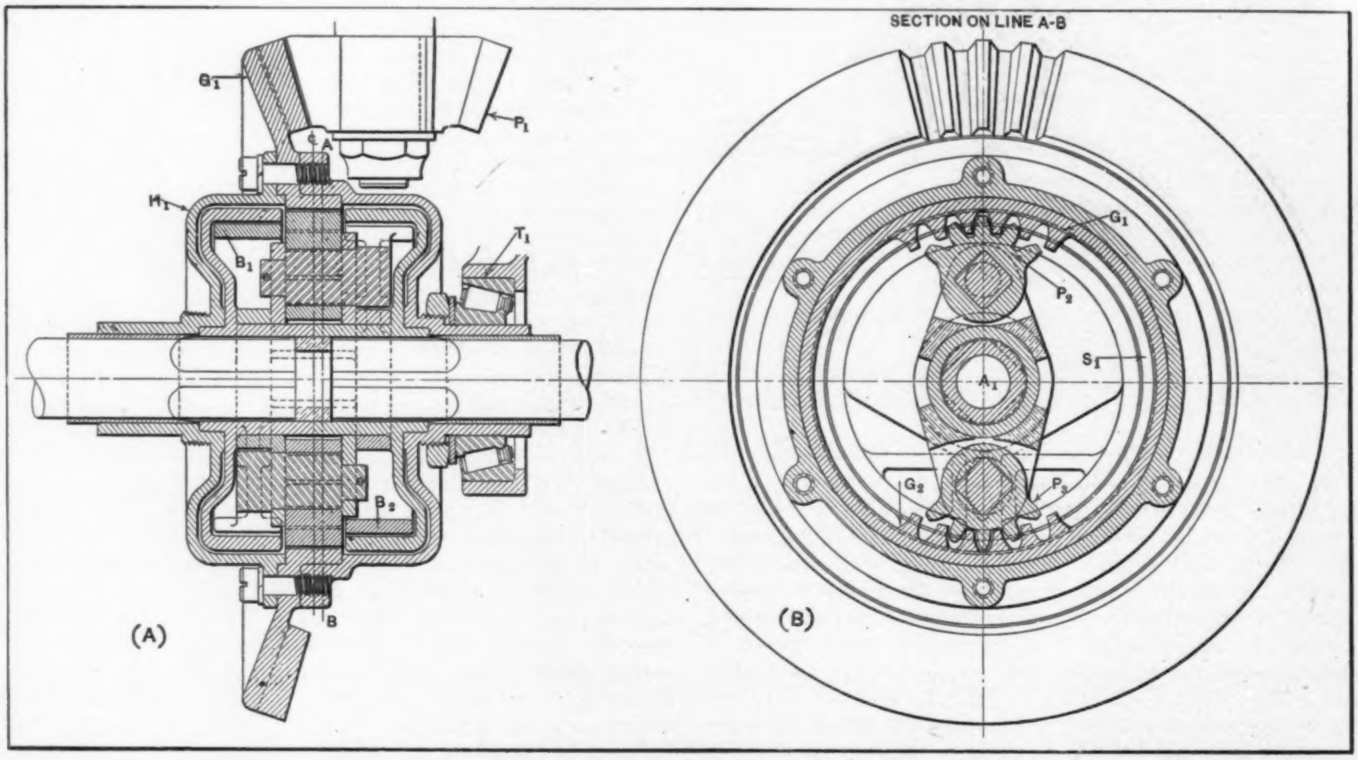


Fig. 13 (A)—Longitudinal section of assembled differential gear; (B)—Cross section of the same

(C) If the road condition is varying and one of the traction wheels drops into a soft spot, the amount of power that may be taken by the other is reduced by the lack of traction of the wheel resting on the soft spot, and if the conditions become sufficiently bad the wheel that is resting upon the soft spot will turn backward and the other wheel will stand still so that effective traction is defeated.

The reason for using a differential of this type is to permit of driving on a curve without having to slip one of the wheels. The disadvantage (C), while it represents a serious condition that must be reckoned with, is less than that which would obtain were there no means for preventing slipping when an automobile is going around the curve.

The Graham differential gear, as illustrated in Fig. 13, shows a section parallel to the axle at (A) and a section at right angles to the axle at (B). This gear is manufactured by the Graham Differential Gear Company, with an office at 2123 Michigan avenue, Chicago, Ill., and the principle of operation departs from

spot on the road, when if it slips the outer wheel takes the work. If the outer wheel can travel faster than the inner wheel, provided the roadbed is firm, it stands to reason that the inner wheel if it slips will overhaul the outer wheel, which the construction permits, in which event the outer wheel will take the work until the time arrives when the inner wheel is permitted to take up its burden again.

Referring to (B), Fig. 13, P2 and P3 are pinions, each on independent spiders revolving around the axis A1. These pinions mesh in the teeth of the internal gear at G1 and G2 on the common spider S1. One pinion P1 is rigidly attached to one of the jackshafts, and the other pinion P2 is rigidly attached to the remaining jackshaft. Referring to (A), Fig. 13, there are two brake bands, B1 and B2, which are actuated when power is applied through the pinion P1 from the motor by way of the propeller shaft, thence to the gear G1, and finally to the housing H1. From the housing H1 the power is transmitted to the teeth G1 and G2 of the spider S1, causing the pinions P2 and P3 to

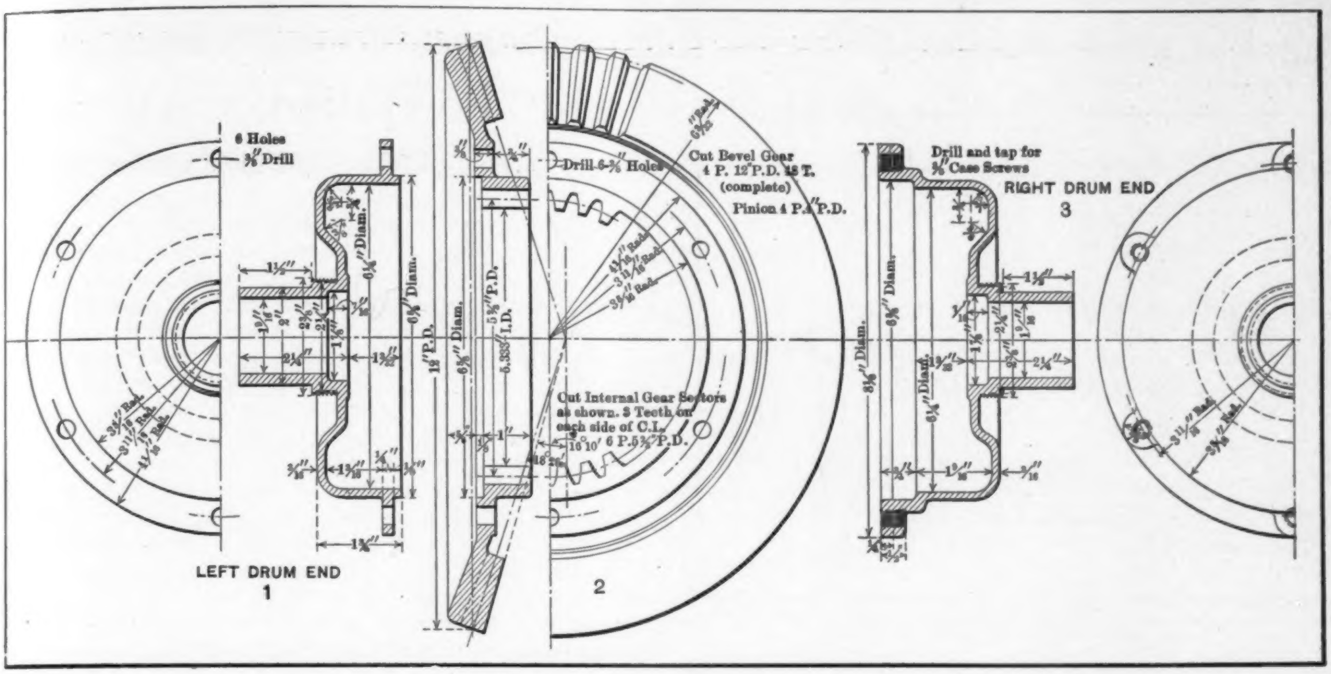


Fig. 1—Left drum end; Fig. 2—Bevel gear; Fig. 3—Right drum end

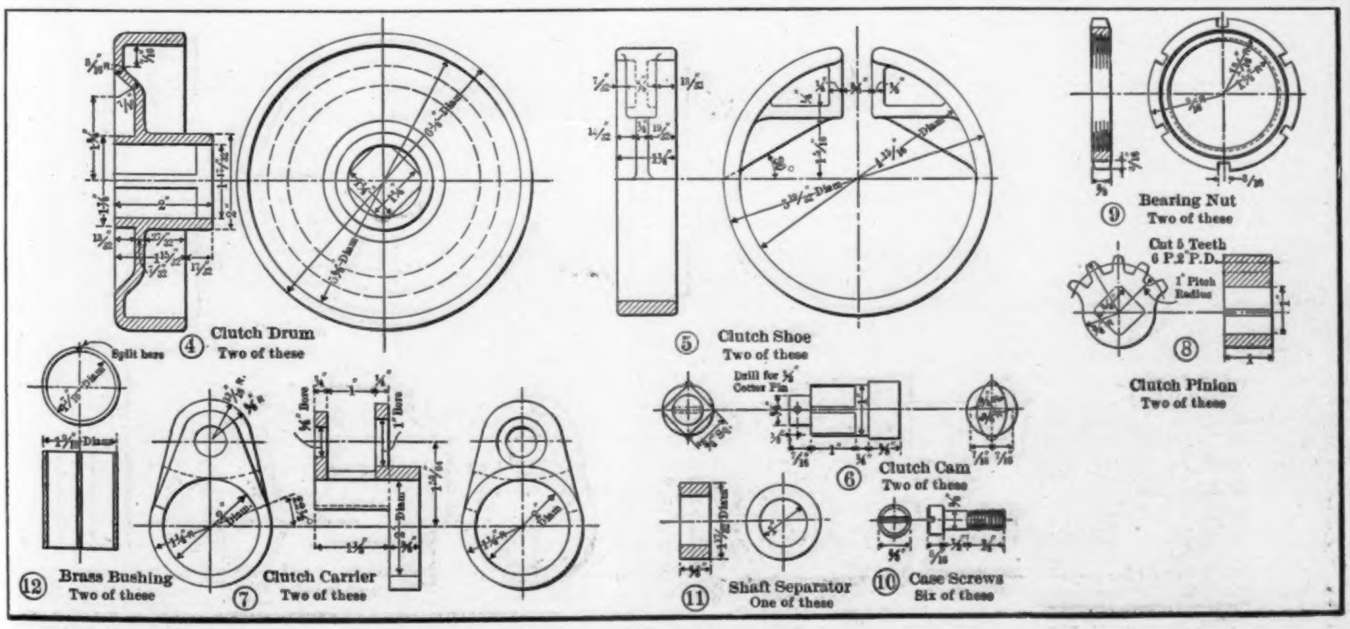
rotate, thus imparting motion to a cam, which in turn expands the brake bands, and completing the drive.

It is possible for one wheel to rotate faster than the other, due to the simple process of overhauling and the straightening up of one of the cams in response to the motion. Under such conditions the remaining cam and one of the brake drums in rigid relation with its band afford the means of driving. Under ordinary conditions the inner wheel does this work, but it is not essential to success that either of the wheels does the driving. As the construction shows, the wheel that travels the slowest is the one on which the work will come. This low speed may be due either to the negotiation of a curve or lack of traction of the other wheel.

The brake bands are provided with cork inserts and they carry the load with great certainty, due to the fact that the bands are expanded before rotary motion is imparted to the members, so that relative motion is obviated. Moreover, the construction is such that the pressure causing expansion of the bands increases in greater proportion than the torque, hence the conditions that are ordinarily chargeable to the failure of brakes are eliminated.

The proportions of the Graham differential are such that it will go in the housing as ordinarily provided for conventional differential gears, and the weight of the mechanism compares favorably with the other means at hand. A better understanding of the needs will be found by glancing at Figs. 1, 2 and 3, representing the left drum end, the large bevel gear and the right drum end respectively, they being shown in plan and section. Considering the importance of differential gear systems, and the necessity of having the parts of good design and stable, it was deemed expedient to reproduce here all the parts employed in this gear, so that Figs. 4, 5, 6, 7, 8, 9, 10, 11 and 12 are given as representing the miscellaneous parts and fittings required.

It may be interesting to observe that the conventional types of differential gears offer unusual disadvantages under certain conditions, as when the roadbed is poor and the load is heavy. The Graham differential is being taken up to supplant other types of gears under these severe conditions, and it seems to be efficacious for the purpose.



Figs. 4 to 12, inclusive—Parts to scale with sizes given

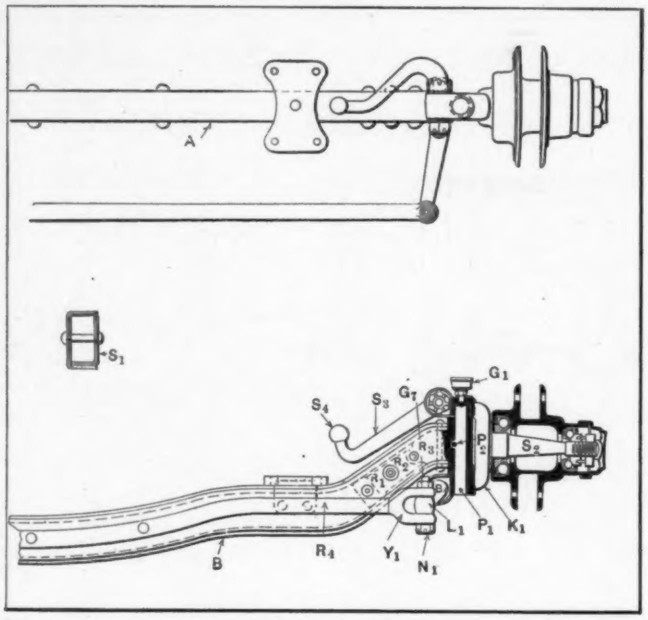


Fig. 2—Plan and section of A. O. Smith type of pressed-steel front axle using cup-and-cone ball bearings

The Halladay Automobile

RECOGNIZING the necessity of being able to give to a discriminating clientèle the character of automobiles it expresses a preference for, the Streator Motor Car Company, Streator, Ill., builder of the "Halladay," presents for 1911, among its several models, the Model 40, which is the subject matter here. The specifications of this car are offered in tabular form for the sake of brevity and utility, and the general appearance of the car, as it is designed for touring, is shown in Fig. 1. Referring to the design of the body, it is of the convertible type, i.e., if the purchaser elects to take a touring body as shown in Fig. 1, it is with the understanding that it can be converted into a "gunboat" at short notice and small cost. Just how this is accomplished is shown in the illustration of the body, and the method of doing the work is clearly described in connection therewith.

Points of Note in the Front Axle Design

The front axle is shown in Fig. 2 in plan at A and in part section looking at the front in B. The axle is of the A. O. Smith pressed-steel type, the section of which is shown at S1. Referring to the front view B, the knuckle casting is a close fit in the pressed-steel axle and is riveted at R1, R2 and R3. The knuckle pin P1 passes clear through, is prevented from dropping out by a tangent pin P2, and has a grease cup G1 at the top. The knuckle K1 is a drop forging of special steel, annealed to subdue internal strains. The spindle S2 is machined and ground so that the inner races of the cup-and-cone bearings are a sucking fit. The cross rod R4 is of large diameter of annealed drawn steel tubing, with a yoke Y1 with liberal bearings accommodating its mate on the end of the lever L1, and the hardened bolt B1 is provided with a grease cup G2 in its head, and a castellated nut N1, with a locking pin at the other end. The steering arm S3 is of special steel with a large diameter sphere S4 on its end, which accommodates the socket of linkage between it and the arm on the steering post. The material and workmanship throughout are up to a fitting standard, with all the parts carefully heat treated to induce a proper measure of kinetic ability. Referring to Fig. 3 of the live rear axle and torsion tube combined, it will be observed that drawn and pressed steel tubings and housings are used throughout. The differential gear system D1 is of the bevel type, and the jackshafts J1 and J2 have square ends S1 and S2 where they fit into the "suns" of the differential system. Cup and cone bearings are employed at every point with locking adjustments so arranged that lost motion may be taken up if in the course of time it is developed.

SPECIFICATIONS OF HALLADAY

MODEL	Price	H.P. A.L.A.M.	BODY		MOTOR				COOLING		IGNITION		Lubrication
			Type	Seats	Cylinders	Bore	Stroke	Cyl. Cast	Radiator	Pump	Magneto	Battery	
"40"	$1650	32.4	Tg. Toy Rt.	5	4	4½	5	Single	H'comb	Centrif'l	Bosch	Dry	Pump

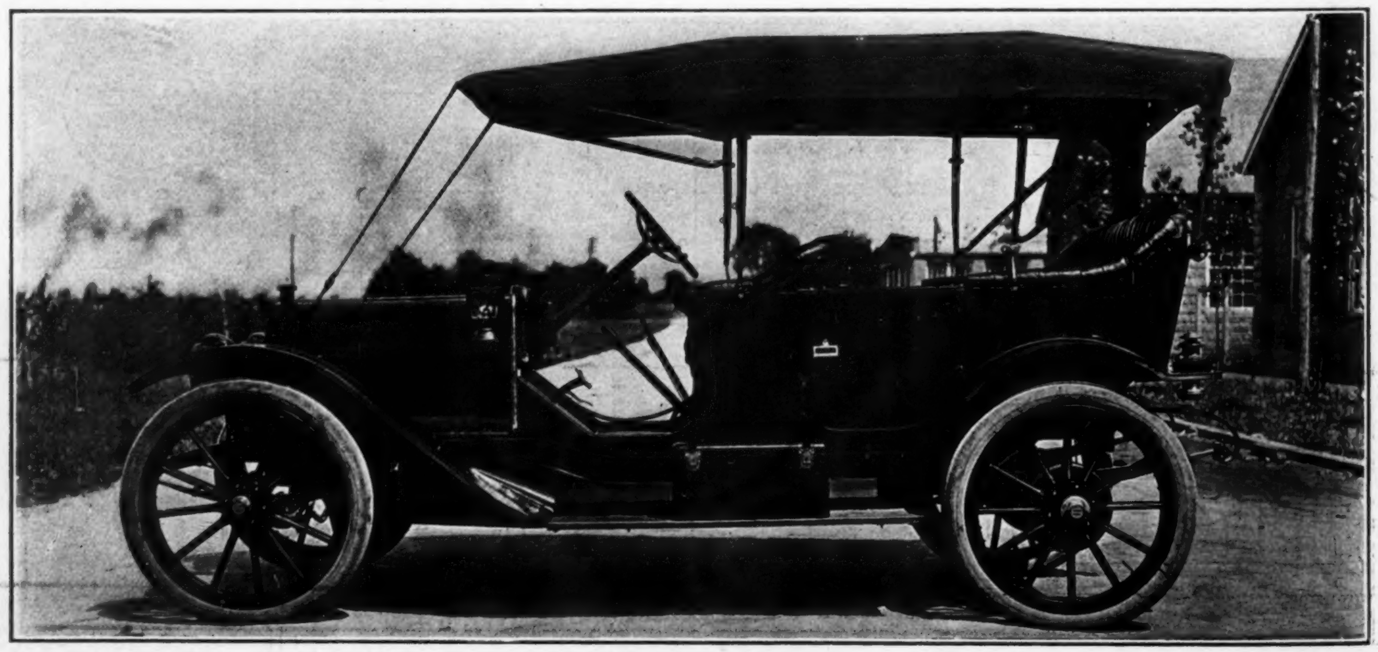


Fig. 1—Model "40" Halladay with a conventional straight-line touring body and means for converting same into a gunboat at any time

FOR 1911. THIS IS SO MADE THAT IT CAN BE CONVERTED FROM A NORMAL TOURING TYPE TO A FORE-DOOR PROPOSITION

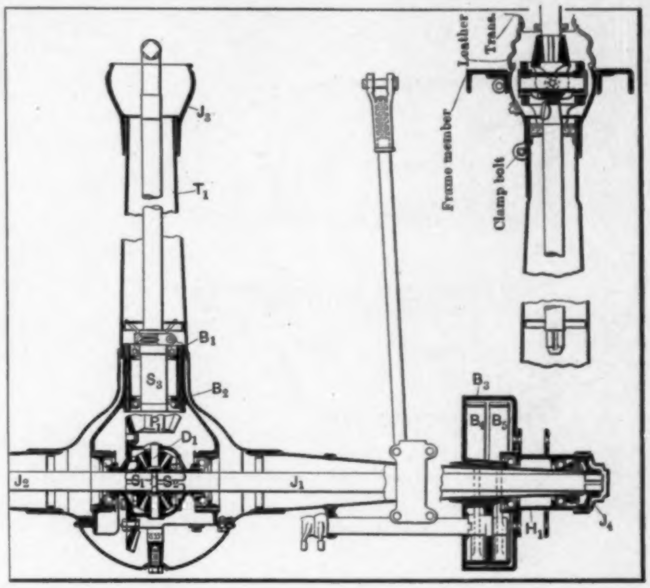


Fig. 3—Pressed-steel type of live rear axle, section to show bevel differential and two pairs of internal expanding brakes

The bevel pinion shaft S3 has two bearings B1 and B2 with a considerable spacing between them, and the pinion P1, which is carried by the bearing B2, is fitted close up to the bearing so that the cantilever effect is reduced to a minimum. The torsion tube T1 is shown in two planes, and the universal joint J3 at its extremity is relatively large, fitting into a socket which in turn is supported by a substantial cross member of the chassis frame. The hub H1 shown at the right is accurately machined, and driving takes place through a jaw J4 so that the construction has all the virtues of a floating system. The brake drums, one of which is shown at B3, are of large diameter, housing the brakes B4 and B5 alongside of each other, so that both the service and emergency brakes are of the internal expanding type, hence protected from the silt of the road and rendered effective by a straight line system of links and levers.

The Multiple Disc Type of Clutch and Housing

The clutch used is of the multiple disc type as shown in Fig. 5 and is flanged on the flange F1 of the crankshaft, being centered at C1 and securely bolted in the manner as shown. The driven member D1 rotates on a plain bearing with a bushing B1, and the discs D2, of which there are a suitable number made of saw-blade steel, have the especial virtue of being conical on their friction faces, and it is also worthy of note that the driving faces D3 for the outside and D4 for the inside are extra large. The housing H1 is oil tight and the cover C2 has a bearing B2 at the shaft and an oil tight joint J1 where it fits the housing H1. The clutch spring S1 has seven turns, using a large diameter wire, thus affording a sufficient pressure to prevent the clutch from slipping under the most severe conditions. Thrust is taken by a ball bearing D3, and one member of the universal joint U1 is shown in place on the taper of the shaft with a locking nut L1 to hold it in place. The clutch is released when the pedal is pressed with a pressure of approximately 40 pounds, which pressure is transmitted to the trunnions T1 and T2 through a suitable motion.

"40" AS OFFERED FOR 1911

	TRANSMISSION							BEARINGS				TIRES	
Clutch	Type	Speeds	Location	Drive	Wheelbase	Tread	Frame	Crankshaft	Transm's'n	Axle	Weight	Front	Rear
Mul. Disc.	Selecti'e	3	Unit	Shaft	118	56	P. St'l	Plain	Ball	Cup and Cone	2750	36x3½	36x3½

An Innovation Resides in the Touring Body

The Model Forty body is shown in Fig. 6 with the plan at A, side elevation at B and cross section at C. All dimensions are given and the general appearance of the body when it is entirely completed, as per plan, is that of a fore-door type along gunboat lines. The innovation hinted at is involved in the construction by means of which the body may be delivered to the purchaser as a strictly touring type, without fore-doors, but the arrange-

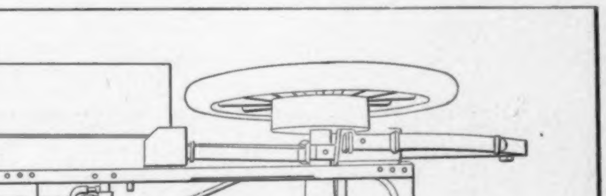


Fig. 4—Stripped chassis, showing relations of units mounted on the double-drop I-section frame. This wax cut was made from a photograph of the car as it stood on blocks, resting on two wheels

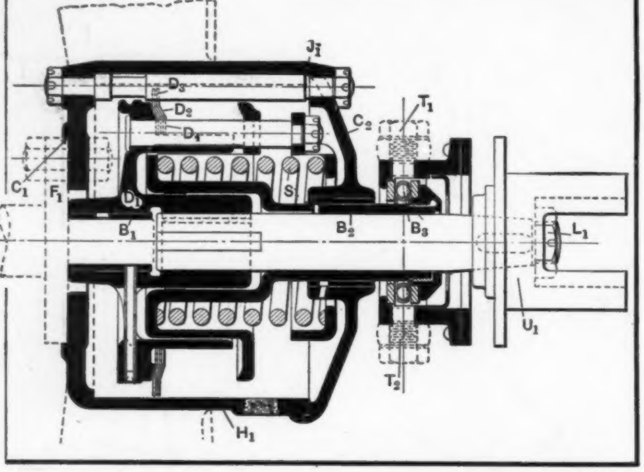


Fig. 5—Multiple-disc clutch within the flywheel confines, with a stout spring and ball-thrust, and an oil-tight housing

ment of the framing at the front is such that the fore-doors may be added at any time at no great cost and without delay.

A close examination of the front end of the body as depicted in the side elevation B will show the dash D1 with a cowl C1 fitted over it, sweeping back to the jam of the door J1, supported around the rim R1 by a bead and at the lower point by the footboard F1 as well as at the framing below. The fore-door is shown in the section through EE, and a foot note at the bottom states "sills must be made to fit sillplates." The design includes an aluminum accommodation piece which is so fashioned that it will fit readily into place on the regular touring body, and by removing the old dash and substituting the new one as before described the entire undertaking is consummated without having to alter the body in any way, but the finished appearance is up to the most exacting demand so that the autoist who purchases a car of this make may have his choice of this car with a touring body of the conventional type with the full understanding that it will be converted to a fore-door type of body at any later date, thus giving him a choice and an option. The character of material, workmanship and finish as represented in this body is in keeping with the latest and most approved practices.

Worm and Sector Steering Gear with Ball Thrusts

The importance of a substantial steering gear is recognized as fitting, and the Gemmer type of worm and sector gear as shown in Fig. 7 is used on this car. The worm W1 is of hardened special steel, meshing with the sector S1, which in turn is pressed onto the shaft S2, and keyed by the key K1. The housing H1 is oil tight and thrust is taken by thrust bearings T1 and T2. The spark and throttle control is interpreted by bevel systems B1 and B2, driven by concentric shafts S3 and S4 within the worm shaft, with a protecting shell outside. The steering wheel W2 is of mahogany, fitted over the rim R1 of the spider, and the spider is keyed to the shaft (on a taper) using two Woodruff keys K2 and K3. It is also pressed down by means of a nut N1. The spark and throttle control levers are shown in part section above the steering wheel. The section A in the left bottom corner of the illustration affords another view of the worm and sector, thus rendering the whole construction sufficiently clear to make further discussion unnecessary.

Annular Ball-Bearing Type of Transmission Gear

The scheme of design of the transmission gear is shown in Fig. 8, which is a section in the vertical plane, cutting through

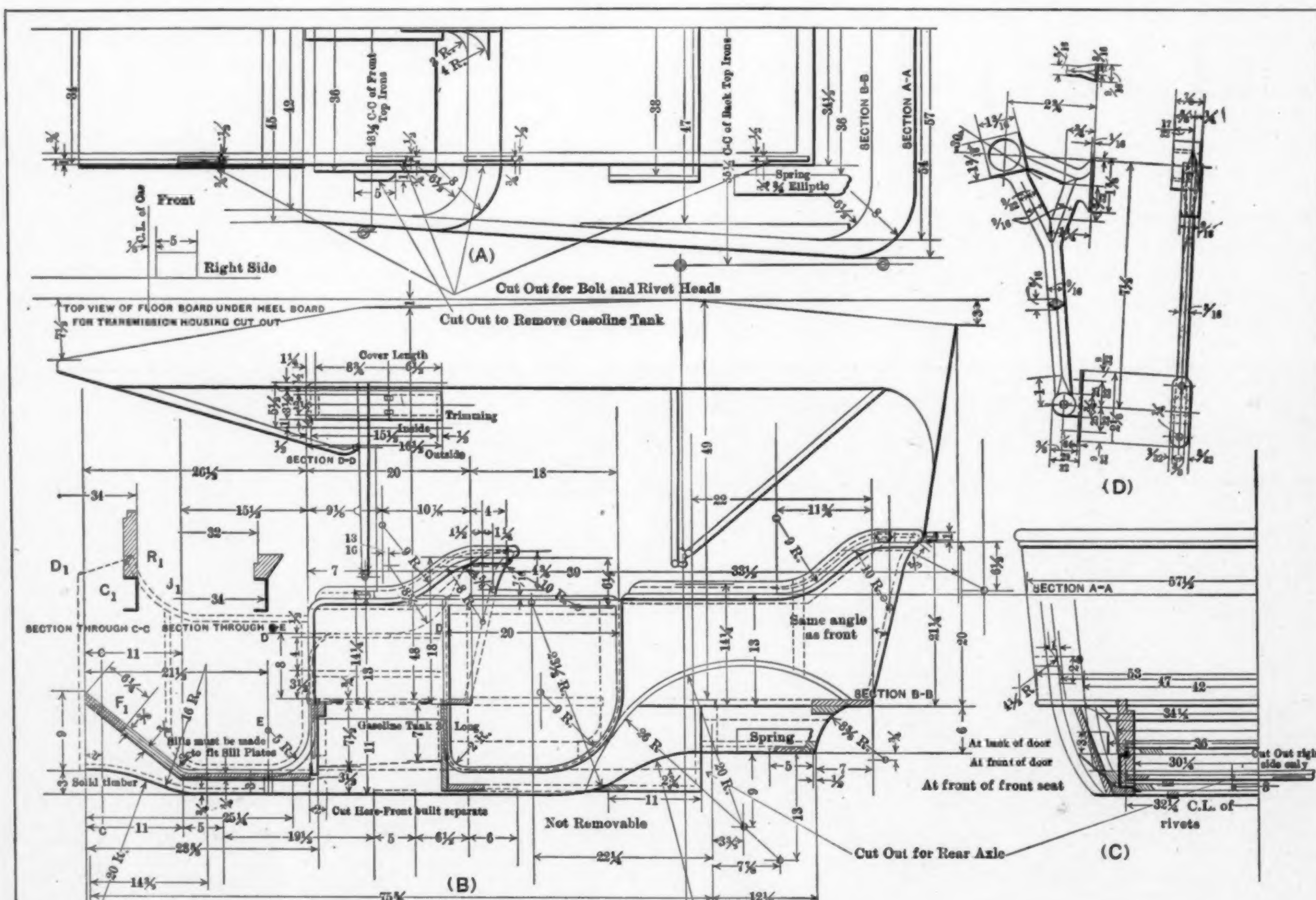


Fig. 6—Working drawing of the convertible body, showing means for quickly transforming the same from a touring type to a gunboat

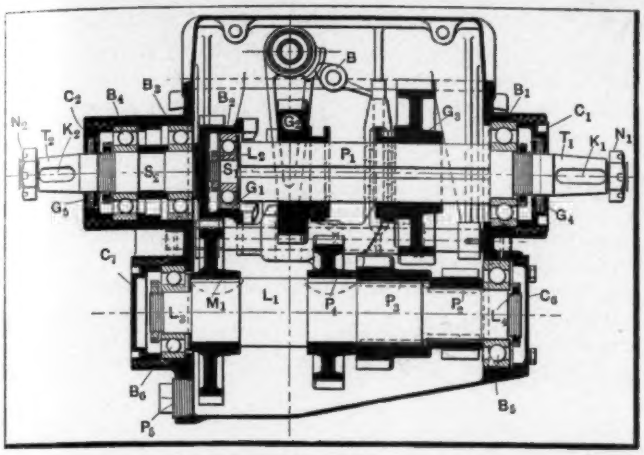


Fig. 8—Section of the transmission gear of the selective three-speed type with stout spindles centered on F. & S. annular ball bearings

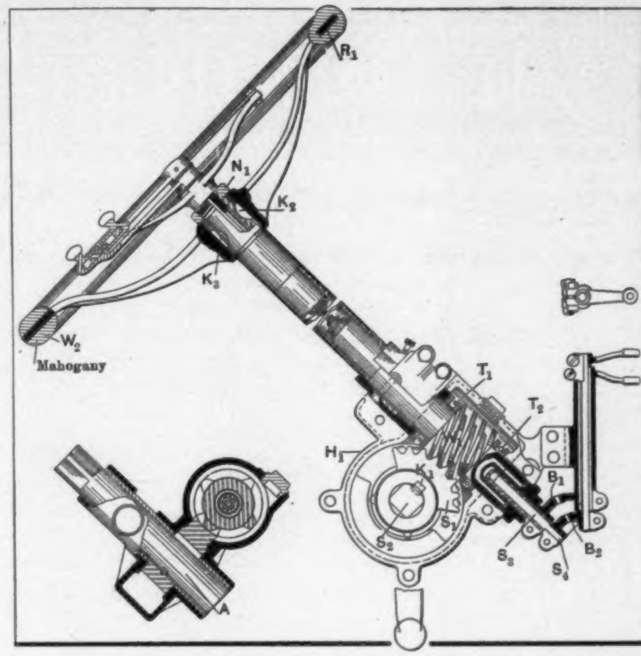


Fig. 7—Worm-and-sector type of Gemmer gear with internally located concentrically disposed spark and throttle mechanism

the prime and lay shafts. Referring to the prime shaft P1, which is directly above the lay shaft L1, it is centered in a large annular-type ball bearing G1 at the end, and where it engages the jaw drive a ball bearing B2 is a sucking fit on the shouldered portion of the shaft S1 with a locking nut L2 placed to hold the inner race in secure relation. The outer race is a hand fit in the bore of the internal gear G1 with endwise freedom. The ball bearing is therefore in a position to do its work without having to resist thrust, and the design is such that the bearing affords a relatively large factor of safety. The sliding gears G2 and G3 are fitted over the square shaft P1, and the pinion for low gear P2 on the lay shaft L1 has a large surface, is a press fit and is provided with two keys. The pinions P3 and P4 as well as the master gear M1 are also keyed on, but they are so much larger in diameter than the pinion P2 that trouble from this source is not to be anticipated. The stub end shaft S2 has two ball bearings B3 and B4 with center distances between them sufficiently great to eliminate lost motion. The lay shaft L1 is provided with large ball bearings B5 and B6 with a sucking fit on the shouldered portion of the shaft on each end and locking nuts L3 and L4 holding the inner raceway securely in place while the outer races are a hand fit, hence self-aligning. Both shafts are of large diameter and relatively short; deflection is therefore aborted and the ball bearings throughout are provided with closures in the most approved way. For the prime shaft the closures C1 and C2 screw into place, making the housing perfectly tight, and oil is prevented from migrating out by the grooves G4 and G5. The lay shaft covers or closures C6 and C7 are not provided with openings because the shaft does not protrude through. The universal joints are fetched up on tapers T1 and T2 on a basis of 1½ inches to the foot, the idea being to provide a slow taper so that a small amount of pressure will force the joints on so that they will withstand the torsional effort without requiring the keys K1 and K2 to do very much work. Castellated nuts N1 and N2 are provided and screw up against the hubs of the universal joints, forcing them up upon the tapers, after which the castellated nuts are locked. At the lowest point in the aluminum case a 1-inch taper plug P5 is provided, by means of which the whole interior of the case may be flushed out, thus making it possible to clean out "shabby" lubricating oil, replacing it with new "slippery" product. There are other nice features that might be lingered upon, but the general character of the design, construction and workmanship of the transmission gear are brought out in sufficient force to satisfy the purpose here.

Coming Events

CALENDAR OF FUTURE HAPPENINGS IN THE AUTOMOBILE WORLD THAT WILL HELP THE READER KEEP HIS DATES STRAIGHT—SHOWS, RACES, HILL CLIMBS, ETC.

Dec. 1............Chicago, Ill., First Annual Aeronautical Exhibition in the Coliseum.
Dec. 31-Jan. 7, '11..New York City, Grand Central Palace, Eleventh Annual International Automobile Show.
Jan. 7-14, 1911...New York City, Madison Square Garden, Eleventh Annual Show, Pleasure Car Division, Association of Licensed Manufacturers.
Jan. 16-21, 1911..New York City, Madison Square Garden, Eleventh Annual Show, Commercial Division, A. L. A. M.
Jan. 28-Feb. 4, '11..Chicago Coliseum, Tenth Annual National Automobile Show Under the Auspices of the National Association of Automobile Manufacturers, Inc., Pleasure Cars and Accessories, Exclusively.
Feb. 6-Feb. 11, '11..Chicago Coliseum, Tenth National Automobile Show Under the Auspices of the National Association of Automobile Manufacturers, Inc., Commercial Vehicles, Pleasure Cars, Motorcycles and Accessories.

Races, Hill-Climbs, Etc.

Aug. 16-27.......Munsey Tour.
Aug. 26-27.......Elgin, Ill., Road Race, Chicago Motor Club of Chicago, Ill
Aug. 31.........**Minnesota State Automobile Association's Reliability Run.**
Aug. 31-Sept. 8..Kansas City, Mo., Reliability Run, Auto Club of Kansas City.
Sept. 2-5..........Indianapolis, Ind., Speedway Meet.
Sept. 3-5..........Run and Labor Day Race Meet of North Wildwood Automobile Club.
Sept. 3-5..........Brighton Beach, Two-day Track Meet.
Sept. 5..........Cheyenne, Wyo., Track Meet.
Sept. 5............Denver, Col., Road Race, Denver Motor Club.
Sept. 5............Los Angeles, Cal., Speedway Meet.
Sept. 5-10........Minneapolis, Minn., Track Meet at State Fair.
Sept. 7-10........Buffalo, N. Y., Reliability Run, A. C. of Buffalo.
Sept. 9-10........Providence, R. I., Track Meet.
Sept. 10..........Los Angeles, Cal., Mount Baldy Road Race.
Sept. 10..........San Francisco, Cal., Golden Gate Park Road Race, Automobile Club of San Francisco.
Sept. 10-12.......Catskill Reliability Contest and Hill Climb, Motor Contest Association.
Sept. 10-12.......Seattle, Wash., Race Meet.
Sept. 15..........Algonquin, Ill., Annual Hill Climb of Chicago Motor Club.
Sept. 16-26.......Asbury Park, N. J., Aviation Meet, Aero Club of America.
Sept. 17..........Syracuse, N. Y., Track Meet of Automobile Club of Syracuse, Syracuse Automobile Dealers' Association and the New York State Fair Association.
Sept..............Chicago, Commercial Car Reliability Contest of Chicago Automobile Club.

THE AUTOMOBILE

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The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

PURCHASERS are much concerned about the body problem this year. Will they be safe in acquiring a conventional type of touring body or will the fore-door type prevail?

* * *

AUTOMOBILE bodies and millinery are discarded when they go out of style. It is at some cost in both cases.

* * *

WHEN millinery is discarded the head of the owner is retained and it is usually capable of further service. When an automobile body is rendered *hors de combat* by the dictator of style the whole contrivance, including the body, is disposed of at a small part of the total cost.

* * *

ECONOMISTS are watching the automobile industry, hoping, perchance, that some way will be found to prove to the average mind that it is an economic waste.

* * *

HOMBRE de un libro (man of one book), the average economist, looks through a dollar, or for a dollar-owner, more likely than not, but the fact remains that it is a gross extravagance to cast off a $2,000 automobile to get rid of a $400 body.

WHAT is the right solution of this vexing problem? Is it to come by educating the owner, who, lacking in stamina, abandons a serviceable body just because Jones, his neighbor, has one that looks different?

* * *

CONVERTIBLE bodies offer attractions from this point of view, and it is the plan of at least one maker this year to offer an option with the body. If the purchaser elects to acquire a conventional type of touring body it will be with the full understanding that it will be converted into a fore-door type of body at any later date if the purchaser so wills it.

* * *

GAUGING the automobile business is a process that can only be conducted successfully if the instrument of precision employed is one that will present the result in known and well-recognized terms. The breaking of the record by the Stearns car at Brighton Beach, advancing the standard 57 miles from 1,196 to 1,253 miles in twenty-four hours, represents something of the real advance that the automobile has made within a year.

* * *

BUT the situation is considerably better than is shown by this new record. Tire trouble interfered seriously with the performance not only of the Stearns but of the other contestants as well. To whatever extent tire trouble retarded this performance account should be taken, and in the final sum-up it must be remembered that the strain on a car increases as the velocity square. In interpreting this statement it is equal to saying that there is no test to which an automobile can be put that is equal to a record-breaking run on a circular track.

* * *

APROPOS of the tire problem it may not be out of place to call attention to the fact that the main proportion of it is due to running on partially inflated tires. The autoist who prefers to use the tires in the capacity of springs will find them high-priced for the purpose. The man who sets up the claim that a tire is fully inflated simply because he is wearied of pumping is, of course, wrong. What he needs is a power pump.

* * *

BUDDING autoists are the most inclined to jump to the conclusion that cotton, as a fabric, is lacking in strength, hence incapable of sustaining under considerable pressure. It is a great mistake to undertake to relieve a tire from pressure by the infernal expedient of running it in a partially inflated condition.

* * *

THE fact that a tire is not wholly inflated by the man who injects the air into it will not reduce the working pressure by a hair. When the weight of the car together with the inertia component comes on the partially inflated tire, the working pressure will be just as high as it would be under fully inflated conditions. There is the added misfortune of flexure with a partially inflated ire, to which must be ascribed the greatest reason why tires do not last too long.

Detroit Trade News

HAPPENINGS OF THE WEEK IN THE AUTOMOBILE MANUFACTURING CAPITAL—NEW CORPORATIONS, FACTORY GLEANINGS, NEW AGENCIES, TRADE CHANGES, ETC.

DETROIT, Aug. 22—Another accession to the ranks of small car makers is the Whitney Motor Car Company, which has just been incorporated with a capital stock of $150,000. It is the intention to manufacture a gearless friction drive roadster that will sell around $400. Brock C. Eby is president of the company; J. C. Hudson, vice-president; H. C. Whitney, secretary, and George O. Taeckels, treasurer.

The recently organized Universal Motor Truck Company has filed articles of incorporation, placing its capital stock at $350,000. Coincident with this, C. H. Haberkorn has resold to the Universal Motor Truck Company the factory site he recently purchased in the north end of the city, and ground will be broken this week for the new plant.

The Paige-Detroit Motor Car Company has increased its capital stock from $100,000 to $250,000, in anticipation of large extensions for the coming season. James Borquin, superintendent with the Chalmers Company since its inception, has severed his connections with that concern, and becomes general factory manager for the Paige Company, which means a livening up all along the line.

Commencing September 1, the Maxwell-Briscoe-McLeod Company, Michigan distributors for Maxwell and Columbia cars, will change its name to the United Motor Detroit Company, in conformity with the plan being followed wherever selling branches of the United States Motor Company are found.

Edward R. Hewitt, of New York, is now a stockholder in the Metzger Motor Car Company and one of its staff of technical experts. Mr. Hewitt was for years the moving spirit in the Hewitt Truck Company, taken over by the Metzger people about a year ago. Since that time he has been identified with the same line, but henceforth the benefit of his experience will be given to the pleasure as well as commercial cars being turned out by the Metzger Company at its Detroit plants.

A "sociability" run will be held by Detroit motor enthusiasts next Sunday, and to arouse added enthusiasm Albert R. Smith has donated a handsome silver loving cup as a trophy to the driver making the nearest approach to the time Mr. Smith occupied in covering the course. The road leads from Detroit through Plymouth, Pontiac, Utica and back to this city. From the number of entries received the run promises to be a great success.

The Michigan Buick Auto Supply Company has filed articles of incorporation, with a capital stock of $2,000,000.

The E-M-F Company has leased the four-story brick structure at Fourth and Abbott streets, just vacated by the Detroit Bag Company, and will devote it to some of the many ramifications of the motor car business as conducted by this concern.

Quite the most interesting bit of personal news to local automobile circles comes with the acquisition by the Hudson Motor Car Company of Edward H. Broadwell, vice-president of the Fisk Rubber Company. Mr. Broadwell recently acquired stock holdings in the Hudson company, and has been elected second vice-president of the company. He will assume complete charge of the selling end of the business, and will have as his assistant sales manager E. C. Morse. "Ned" Broadwell has been associated with the motor car industry from its inception, and for the last ten years had been with the Fisk Rubber Company, the last five years serving as vice-president. He assumes his new duties September 1.

The Ford Motor Company has begun the erection of a $30,000 addition to its Canadian plant, located just across the river, in Walkerville. When completed this will give 20,000 additional square feet of floor space. Work is also being rushed on the company's new salesroom at Woodward avenue and the Boulevard. The structure, which will be ready for occupancy late next month, is of reinforced concrete, 100 x 100 feet on the ground, and three stories in height, although it is the intention to ultimately increase it to eight. When completed it will be one of the most imposing showrooms in the city.

The Wagenhals Commercial Motor Car Company, of St. Louis, Mo., will shortly locate in Detroit and engage in the manufacture of a three-wheeled light delivery car, which combines many novel features, chief of which, of course, is the elimination of the customary rear axle, differential and other standard parts.

As usual, the automobile is proving a strong factor in the political campaign now being waged throughout the State. Chase S. Osborn, who is seeking the Republican nomination for Governor, has been touring Michigan in a Regal car for some weeks. Other candidates who find the railroads inconvenient are employing similar means of transit, and are covering four and five towns a day, whereas under the old way but two towns could be covered.

The first light delivery cars for the Van Dyke Motor Car Company began coming through the west side factory last week, and it is expected that in a short time the plant will be turning out twenty-five machines a day.

Pending the completion of a magnificent garage at Woodward and Alexandrine avenues, ground for which has just been broken, the Elmore Motor Car Company has established a temporary agency for Michigan and Canada at 295 Jefferson avenue, with M. A. Young in charge. The business here will be conducted under the style of the Elmore Automobile Company and a complete line will be carried.

Some two dozen Cadillac sales agents from all parts of the country organized an association known as "The Old Guard" in Detroit recently. Each member has been in the service of the company at least five years. The association will meet three times a year, in January at New York, in February at Chicago, when the auto shows are on, and in Detroit at the time the new model is ready for the market. G. E. Blakeslee, of Jersey City, the oldest sales agent in the company employ, was elected president. I. M. Uppercu, of New York and Newark, was chosen secretary and treasurer. There are no other officers.

The Lion Motor Sales Company has been organized with a capital of $10,000 to handle the Lion car, made in Adrian, Mich. The officers are: Fred Postal, president and treasurer; Robert L. Fee, vice-president and manager, and Harry Postal, secretary. The same men constitute the Michigan Motor Sales Company, 650 Woodward avenue.

Another Selden Injunction Issued

An injunction has been served by United States Marshal Henkel on C. A. Duerr & Co., of New York, who were formerly agents of the Ford Motor Company in New York, restraining them from making, selling, or using cars infringing the Selden Patent.

Duerr & Co. were defendants in the same suit as that brought against Ford Motor Co., and the injunction now granted against them was served on Charles A. Duerr as president of the company, and Lindsay Russell, as trustee in bankruptcy for the company.

Charles A. Duerr is now New York distributor for a licensed car and the effect of the present action will be to enjoin him from selling anything but cars manufactured under Selden Patent license.

Ready at Elgin

BIG FIELD OF CRACK CARS AND DRIVERS ON HAND FOR THE FOUR BIG RACES

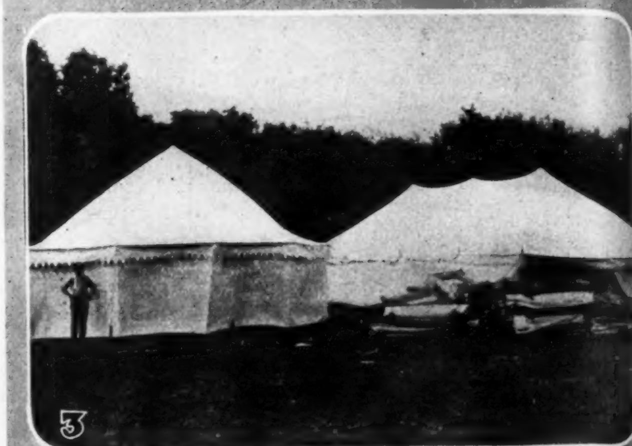
CHICAGO, Aug. 23—Given the same kind of weather as prevails to-day, the national stock road chassis races at Elgin on Friday and Saturday of this week should be the greatest stock car speed carnival that ever has been run on a highway. The Chicago Motor Club, which is putting on the show, has succeeded in getting together a most brilliant field of cars, which are thoroughly representative of the American industry, there being only one foreigner—a Benz in the small car race.

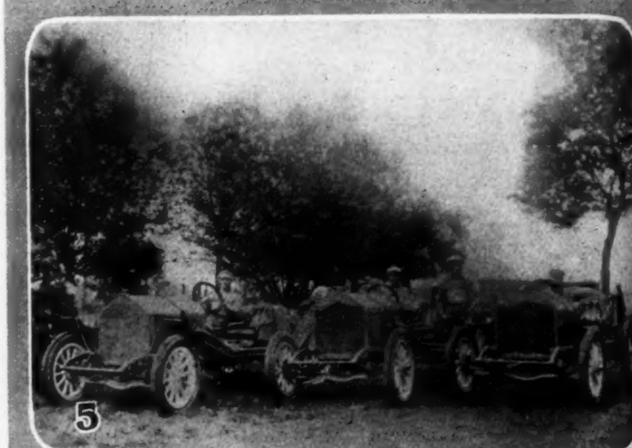
With about all the star drivers in the big race of the meet, the 300-mile Elgin National on Saturday, there should be excitement enough to suit the most fastidious motor enthusiast. The main race of the first day, the Illinois Trophy, has attracted eight entries, which include the National, Falcar, KisselKar, Midland, Marmon and Lexington. In the Kane County there are seven, which takes in the Corbin, Overland, Marmon, Marion, KisselKar and Cino. The Fox River Trophy event, in which the little cars will compete, has eight contenders, three of which are Stavers, two Fords, Warren-Detroit, Cole and Benz. In all, there are thirty-six entries for the four events, representing twenty-two different makes of cars. One that came in at the last minute was the third Staver.

The drawing for numbers took place this morning and the luck of the draw gave No. 1 to Arthur W. Greiner, the Chicago amateur, in the Elgin National event, in which he will pilot a National 40. The National also was fortunate in the Illinois trophy, No. 1 in that event going to Livingstone, the other driver on the team. Joe Matson in the Corbin pulled out the first postion for the Kane County trophy for his car, while the Fox River drawing resulted in Frank Kulick in a Ford drawing first position, although his number is 31. The drawing also showed a switching about of drivers. The Marmon people decided to save Harroun for the last day and put Dawson in the Illinois in Harroun's place, while Louis Heinemann took Dawson's seat in the Kane County. The KisselKar people substituted H. Endicott for Schoeneck in the big race and saved the latter for the Kane County.

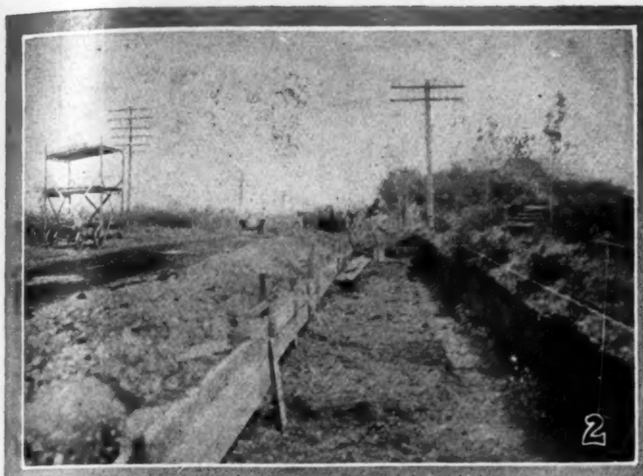
While some of the teams have been in camp at Elgin for more than a week, activities in the training line did not start until yesterday because the course was not completed until the latter part of last week. The circuit was in shape for practice on Friday, but it was decided that it would be better to wait until Saturday. However, when Saturday came there was a heavy rain in the morning so that it was deemed best to postpone the practice until Monday. All conditions were favorable yesterday and some fifteen or sixteen cars were out for their first trial. There was no disposition on the part of any of the drivers to go the limit on their first appearance and most of the two hours of practice was taken up in becoming acquainted with the course. However, there were several bursts of speed, and there were several laps at better than 60 miles an hour. Grant, Harroun, Livingstone and Mulford were among those to show the capabilities of the course in this manner. The drivers declared that the circuit was in admirable shape for the racing and the first day at practice proved that the road commissioners had done their work well. The straightaways were hardly disturbed by the cars and not marked up in the least. Two of the corners stood the gaff well, but the turn at Hornbeek's, which is at the southeast corner of the circuit, was cut up some because of the fact that big trees overshadowed the road so the sun cannot get in its best licks. There was more practice to-day despite the fact that during the night there was a heavy thunderstorm. This rain, however, seemingly had no effect upon the course and by 11 o'clock this morning it was in fit shape for practice.

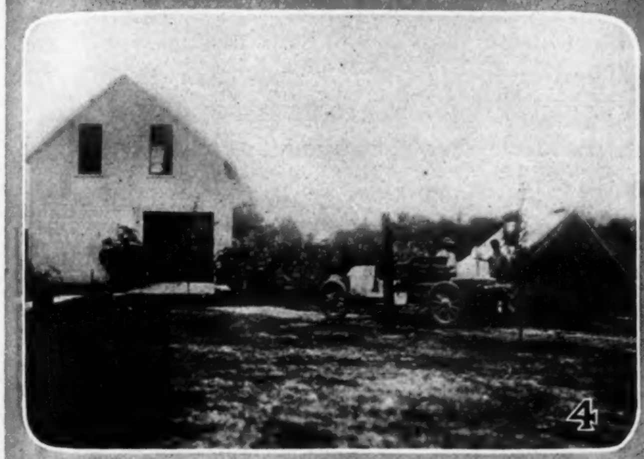
There still remains considerable to do before the race on Friday in the way of completing the racing plant. Workmen still are busy putting in the pits in front of the grandstand, but they are putting up permanent repair depots. Instead of making the pits of wood they are cast in con-





1—"Crow's-Nest" on top of the garage at the National camp
3—These huge tents furnished ideal sleeping quarters
5—The National team—Seek, Greiner and Livingstone
7—Where the hungry racers do congregate at mealtime





crete so that in future years all that will be necessary in order to make them serviceable will be to dig out the dirt which will fill them during the year. The grandstands were completed yesterday; but this is no trick, for the stands are the same that were used during the Masonic doings here in Chicago. They are easily transported and by using them the Elgin association saved considerable money.

In marked contrast with other road races, the Elgin people have made every effort to down extortion. Rooming accommodations can be had in the town for $1 a day, while the storekeepers have shown they possess civic pride by not shoving up their prices. Another thing that will tend to increase the attendance is the fact that popular prices prevail on the course. There is an initial charge of 50 cents for general admission and after that seats may be had in the bleachers for 50 cents, grandstand seats for $1 and box seats for $1.50. Parking spaces are sold for $1 per car, which fact will surprise many who have been accustomed to pay from $10 to $25 for such a privilege. By catering to the masses in this way it is evident that Elgin will draw crowds that will rival the Vanderbilt in size. These crowds will be handled with great facility by the railroads, which plan to run special trains as often as the people fill them.

The course is located within one mile of the heart of Elgin, so that even if the Elgin trolleys which run to the edge of the course cannot accommodate everyone it will be no great hardship to walk. If there isn't a crowd at the races it will not be the fault of the Chicago papers, which have become so interested in the event that they devoted pages to the races last Sunday and are following up this publicity in a manner which cannot fail to bring the speed carnival to the attention of the general public. Already all of the ninety-two boxes have been sold and many reservations have been made in the grandstand.

The Elgin races will not start at daylight, as will the Vanderbilt, for Westerners have not yet been educated to that point, nor can the roads be tied up so early in the morning. Each day's racing will start at 10 o'clock, and the course will be closed by the soldiers at 9 o'clock.

There was a slight change in officials made to-day, when George E. Hunter, of Elgin, was made honorary referee, in place of C. H. Hulburd, president of the Elgin National Watch Co., whose engagements would not permit him to fill the position. Succeeding Mr. Hunter as judge is Walter Egermann, president of the Aurora Automobile Club which presented the Fox River trophy. M. H. Portmer, of New York, will handle the Warner Electrical Timing apparatus that will be used.

Following is a complete list of entries for the four events:

LIST OF ENTRIES FOR THE ELGIN TOURNAMENT

Elgin National Trophy

Car	Entrant	Model	No. Cyl.	Bore	Stroke	Driver
1. National	A. W. Greiner......	1910	4	5	5 11-16	A. W. Greiner
7. National	National Auto. Co..	1910	4	5	5 11-16	A. Livingstone
10. Marmon	N. & M. Co.........	1910	4	4½	5	J. Dawson
4. Marmon	N. & M. Co.........	1910	4	4½	5	R. Harroun
3. Lozier	Lozier Motor Co....	1911	4	4	5⅝	R. Mulford
11. Matheson	Matheson Auto Co..	1911	6	4½	5	G. Reynolds
6. Alco	American Loco. Co.	1909	6	4 4-5	5 3-5	H. Grant
8. Simplex	L. A. Shadburne....	1910	4	5¾	5¾	H. Saynor
9. Kisselkar	H. P. Branstetter..	1910	4	4⅞	4¾	H. Endicott
2. Black Crow	Black Mfg. Co......	1910	4	4 5-16	4⅞	F. Stinson
14. Jackson	R. Temple Auto Co.	1910	4	4⅞	4¾	E. F. Schiefler
12. Knox Six	Knox Auto. Co.....	1910	6	5	4¾	B. Oldfield
5. Simplex	L. A. Shadburne....	1910	4	5¾	5¾	G. Robertson

Illinois Trophy

Car	Entrant	Model	No. Cyl.	Bore	Stroke	Driver
7. National	A. W. Greiner......	1910	4	5	5 11-16	A. W. Greiner
1. National	National Auto. Co..	1910	4	5	5 11-16	A. Livingstone
6. Marmon	N. & M. Co.........	1910	4	4½	5	J. Dawson
2. Falcar	Fal Motor Co.......	1910	4	4⅛	5¼	W. H. Pearce
4. Falcar	Fal Motor Co.......	1910	4	4⅛	5¼	J. F. Gelnaw
3. Kisselkar	H. P. Branstetter...	1910	4	4⅞	4¾	H. Endicott
5. Midland	Midland Motor Co..	1910	4	4½	5	R. Ireland
8. Lexington	Lexi'gt'n M. Car Co.	1911	4	4½	5	R. Drach

Kane County Trophy

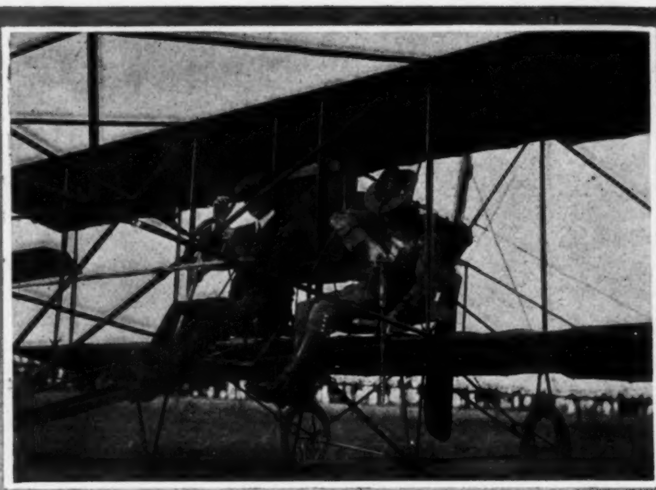
Car	Entrant	Model	No. Cyl.	Bore	Stroke	Driver
23. Marmon	N. & M. Co.........	1910	4	4	4½	L. Heineman
26. Marmon	N. & M. Co.........	1910	4	4	4½	D. Buck
27. Cino	Haberer & Co......	1910	4	4⅜	5	W. Fritzsche
22. Overland	Overland Motor Co.	1910	4	4¼	4¼	A. Schillo
25. Kisselkar	H. P. Branstetter...	1910	4	4¼	4¼	G. Schoeneck
21. Corbin	Corbin M. V. Corp..	1910	4	4⅛	4½	J. Matson
24. Marion	—. —. ————	.....	....	.	.	A. Monsen

Fox River Trophy

Car	Entrant	Model	No. Cyl.	Bore	Stroke	Driver
31. Ford	Ford Motor Co......	1910	4	3¾	4¼	F. Kulick
38. Ford	Ford Motor Co......	1910	4	3¾	4¼	J. Hatch
33. Cole	Cole M. Car Co....	1910	4	4	4	W. Endicott
32. Staver-Chicago	Staver Car. Co.....	1910	4	4	4	C. Cheney
36. Staver-Chicago	Staver Car. Co.....	1910	4	4	4	G. Monkmeier
35. Benz	E. A. Hearne......	1910	4	3½	5½	E. A. Hearne
34. Staver-Chicago	Staver Car. Co.....	1910	4	4	4	A. Crane
37. Warren	—. —. ————	.....	....	.	.	A. W. Miller

2—Hurrying work on the pits opposite the grand stand
4—There is always plenty doing at the Midland camp
6—Showing the stretch of road opposite the Corbin camp
8—Part of the National camp, showing the repair pit

The battle in the clouds—a realistic picture caught by the staff photographer during the aviation meet at Asbury Park



Aviator Curtiss and Lieut. Fickle show utility of aeroplane in war at the Asbury Park meet

The Motor in the Air

CONSPICUOUS EVENTS AMONG AVIATORS DURING THE WEEK—WRIGHT MACHINE FREED FROM FRONT INCUMBRANCE PROVES SUPERIORITY OVER OLD TYPE

AT Asbury Park, a summer resort on the New Jersey coast near New York City, an aviation meet was opened August 10 and was still in progress August 23, though at first arranged for ten days only. The opening days were made notable by two accidents. Dropping from a height of 2,000 feet a parachute jumper named Prince, whose apparatus failed him for causes which have been explained but still remain unknown, met immediate death. The aviators at the meet were all employed by the Wright corporation. One of them, Walter Brookins, tried to make a landing by spiral descent to a certain narrowly defined spot and fell from a height of about 100 feet into a crowd of onlookers, several of whom were injured. Brookins escaped with severe contusions of his face, and appeared again later at the meet, undaunted. Maurice Garsuch, 18 years old, whose skull was at first supposed to have been fatally fractured, has since filed suit for $15,000 damages, and George Burnett, who suffered concussion and dislocation of the hip, is reported to be preparing to enter suit for a still larger amount. The machine was smashed beyond repair. No indictment was found. To replace the destroyed machine a large new Wright biplane was sent to the meet from Dayton, Ohio, and arrived on August 15. Its construction and performances soon became the sensation of the meet and of world-wide importance. All that remains in front of the biplane proper in this machine is the fore part of the skids, the front elevating planes or tilt rudders having been abandoned, and the up-and-down direction is controlled solely by means of a rear horizontal single-plane rudder, as in monoplanes and Voisin biplanes. The size of the new machine is figured sufficient for carrying six persons. In its performances on Monday, August 22, it proved itself capable of much greater mobility, in the acrobatic evolutions by which it was tested and exhibited, than the older Wright type, and it flew steadier in the straightaway and faster. Unless a bad-weather test should eventually prove its equilibrium to be beyond the aviator's control, in greater degree than for the older type, it will therefore be extensively imitated, being in itself an adaptation from other aviation machines.

John Moissant, a cavalier of fortune hailing from Chicago, but known in many other parts, started from Paris with a French mechanic as passenger Tuesday evening, 5:45 o'clock, August 16, and flew to Amiens, arriving 7:40; started from Amiens, after a gay night with friends, Wednesday morning, 5:45, reached the Channel at 10:50 a. m., continued across and reached Tilmanstone, six miles beyond Dover, just at noon. He said he had steered by a compass suspended in glycerine and placed between his feet, being unable to see anything by reason of foggy weather. Several attempts to get from Tilmanstone to London between August 18 and August 22 came to naught through troubles with the Gnome motor, which the French mechanic could not sufficiently remedy. On August 22, according to Associated Press dispatches, Moissant and his companions, in making a last attempt to reach London, only twenty miles away, despite a contrary wind estimated at thirty miles per hour velocity, were hurled to the ground, and the machine was much damaged, while the aviators escaped unhurt. Before this flight Moissant is reported to have flown only five times.

On August 17 a 488-mile cross-country contest, which was divided into laps and arranged so as to give the participants great latitude in choosing time and weather, was won by Leblanc driving a Blériot machine. Auburn was second, and Legagneux in a Farman biplane was in at the finish, though disqualified on a technical point. Several army officers also finished the circuit, but were prohibited from competing. The number of contestants from the beginning included many of the best-known French aviators.

On August 20 Clifford B. Harmon, of New York, a well-known real estate dealer and amateur aviator who has been practising flights with Farman and Curtiss biplanes at Mineola, L. I., flew in a Curtiss machine from Hempstead, L. I., over the wooded land surrounding Roslyn, across the Sound to near Mamaroneck, landing close to the country seat of his father-in-law, E. C. Benedict, and won the Doubleday prize for the first who crossed the Sound.

Industrial Aeroplanes

(*Continued from page* 302.)

Further, as it is the air resistance itself which places the resilient blades at their working pitch, the reaction of the blades against this deflection must be of equal force, and, as this reaction is delivered against the atmosphere at exactly the same angle and otherwise exactly the same conditions as those governing the thrust due to rotation (of either the rigid or the resilient propeller), the total thrust of the resilient propeller must be exactly twice (minus friction losses) that of the rigid propeller.

Through a chain of reasoning no less cogent than simple

mathematics, it is therefore established that a resilient propeller, in which the resiliency has been properly calculated and materialized to equal the resistance against rotation at a desirable pitch, will consume and deliver twice as much power as the rigid propeller of the same desirable pitch and of the same identical dimensions.

This alone places the properly designed resilient propeller in a separate class.

In order to simplify the reasoning it has been assumed here that all of the resistance against rotation is air resistance and that all the air resistance is utilized to deflect the resilient blades. A different assumption simply makes a stronger case for the resilient propeller, reducing the power consumption to be expected of it while maintaining the thrust it delivers as at least twice that of the rigid propeller. The different assumption does, however, affect the spring resistance which should be employed. It should correspond (with allowance for the leverage employed in overcoming it) not to the total resistance against rotation but to that portion thereof which is utilized to cause the deflection. And this is probably equivalent to the portion which is transformed into propulsive thrust by rigid propeller blades. So, the advantages to be gained by means of resilient construction, once its intricacies shall have been mastered, have been rather understated than overstated.

Further consideration of all the factors involved, for which there is no space in this article, leads one to assume that the resilient propeller will eventually do a good deal more than may now be proved for it in words, and especially that the power which it will consume will be taken in practice not from the motor (so as to necessitate an increase of motor power) but from the waste which occurs when motor power is applied to rotate a rigid propeller. No absolutely compelling argumentation can be offered for this contention, but it is known that the thrust produced by the most improved standard propellers nowise corresponds to the power which produced the thrust, coming scarcely within 20 per cent. thereof, and that nevertheless the slip in these propellers is extremely small and perhaps in some cases even negative, so that their efficiency measured by their slip, as customary for marine propellers, approaches 100 per cent. This situation seems to indicate that the rigid propeller, save for what action of a different order may be due to the transverse curvature of the best rigid blades, simply screws itself through the atmosphere but wastes practically all the thrusting capacity which might be gained by adapting the blades to work by "impulsion" as well as by pressure. The importance of impulsion in steam turbine engines being fairly well understood, it would seem rational to attempt to apply a similar principle to atmospheric propellers which act in a medium no less elastic than steam. Bearing in mind the capacity of the resilient propeller for absorbing and delivering a powerful thrust, twice as powerful a thrust as the rigid propeller of the same dimensions can be made to deliver, it may be rash to assume that the resilient construction constitutes the only means for gaining impulsion and a 100 per cent. increase in power economy, but a certain probability is at least established to the effect that the resilient propeller is capable of a highly important practical development. And it is possible to predict, with only one alternative, one of the results, which is the complete abandonment of slip as a measure for the efficiency of atmospheric propulsion (and in fact marine propulsion as well). This follows logically from doubling the thrust of the rigid propeller with a resilient propeller of identical dimensions. The doubled thrust must produce a speedier forward movement, which means a pronounced negative slip. And a negative slip is an absurdity as a basis for measurement. The alternative prediction is that resilient propeller blades will be found to work most effectively at double the pitch used for rigid ones.

The skids in the described aeroplane machine are intended for use with the practically developed resilient propeller.

Thomas Dealers Convene at Buffalo

BUFFALO, Aug. 20—The E. R. Thomas Motor Company's Dealers' Convention closed a three-days' program of business and pleasure with a smoker at German-American Hall this evening. There were speeches made by President E. R. Thomas and other officers, and a vaudeville entertainment was enjoyed by about 90 guests of the company.

Thursday afternoon at 1:30 the dealers took dinner at the factory. After a short business session, they were entertained with a beefsteak supper at the Hotel Lafayette. The dinner was enlivened with bits of comedy contributed by the officers and visitors. This was followed by a theater party.

The business session on Friday morning had for its principal feature an engineering talk by H. G. McComb, chief engineer of the company, dwelling upon the various functions of the chassis and motor, and expatiating upon the new Thomas Flyer.

The afternoon session was taken up with a demonstration of the 1911 models, together with a talk on body construction by A. W. Woodruff.

Mack Wins in Its Class in Truck Roadability Run

The entry of Shave Brothers & Wilson, the Mack, driven by E. Turgeon, has been announced as the tenth winner in the recent roadability run for motor trucks conducted by the Philadelphia *North American* and the Quaker City Motor Club. This was in the class for mammoth trucks (gasoline) above five tons, which was not decided by the contest committee at its meeting last week.

Group photograph of the convention of Thomas Flyer dealers at Buffalo last week

Communications

THE LOGIC OF THE PROPOSITION AS HANDLED BY A MAN FROM NEVADA AND OTHER TERSE COMMUNICATIONS DISCUSSING THE MERITS OF THE AUTOMOBILE FROM AN ECONOMIC POINT OF VIEW

The Logic of the Proposition.—"And there is no new thing under the sun," Ecclesiastes, 1:9. In the words of our text the inspired writer foretold the coming of those prophets of evil, who see peril to our country in the automobile. From the wireless telegraph back to the day when Eve first decided to wear a fig leaf, victims of mental strabismus have shied at every step in the world's progress.

In 1673, just after the introduction of stage coaches, a book entitled, "The Grand Concern of England, etc.," denounced them as among the greatest evils that ever happened to the Kingdom. It alleged that "traveling by coach was calculated to destroy the breed of horses and make men careless of good horsemanship; that it hindered the training of watermen, and seamen, and interfered with the public resources; that those who were accustomed to traveling in coaches became weary and listless when they rode a few miles and unwilling to get on horseback, not being able to endure frost, snow or rain, or to lodge in the fields; that to save their clothes and keep themselves clean and dry, people rode in coaches and thus contracted an idle habit of body; that this was ruinous to trade, for the reason that most gentlemen, before the days of coaches, were wont to ride with swords, belts, pistols, holsters, portmanteaus and hat-cases, which, in the coaches, they have little or no occasion for; for when they rode on horseback they always carried along an extra suit for change at the journey's end or by the way; but in coaches they would ride with a silk suit, an Indian gown with sash, silk stockings, and beaver hat, and carry no other along, because they escaped the wet and dirt which on horseback they could not avoid; whereas, in two or three journeys on horseback these clothes and hats were wont to be spoiled; which done, they were forced to purchase new, and that increased the consumption of manufactures and the employment of the manufacturers, which traveling in coaches doth in no way do."

The logic of the proposition is unanswerable, and the style of reasoning singularly familiar. With slight paraphrasing, it would present, even more convincingly than the most lurid pipe dream, the necessity for aborting the automobile industry.

A friend of mine has just come from Iowa, where he has for many years done business in a large way, and come to know the State and its conditions thoroughly. He tells me that this latest "bugs-in-the-attic" malady is epidemic in that State, and that many of the bankers have it in so virulent a form as to seriously embarrass the farming industry. He further tells me that the increase in actual values in that State within the past ten years, due to the motor vehicle alone, is, on a most conservative estimate, not less than half a billion dollars.

One phase of this subject which I haven't seen referred to is that the present universal, insistent demand for improved highways throughout the length and breadth of this country has come principally because of the motor car. Without it we would not have reached where we are now for the next twenty-five years. As this is a continuous and increasing national asset, it can be measured only as capital, upon which the money value of one year's economic benefit due to the motor vehicle's part of road improvement would be, say, 5 per cent.

Wonder when Ike Partington will give his mother a hunch to cut out the attempt to sweep back the Atlantic Ocean with her broom, and beat it?—James W. Abbott, late special agent U. S. Highway Department, Piocke, Nevada.

A Quandary Which Is Still Quandering—His wife wanted an automobile, just a little one with seats for two and a dog, but he could not quite "see it." There were so many other things he had in mind and knew he would want some time. But now she had finally tucked away $800 out of her own personal savings. It was all in nice clean yellowbacks in a box downtown. The little scoundrel had been knitting fashionable sweaters, while he was at his office, and had sold them regularly to "Francoise," the ladies' outfitter. It was getting hard to resist so much ambition and persistence, hard to tell her about cost of "upkeep" and the valuable time spent in gadding about, interest lost when they did not use "it," garage charges if they stored "it" and insurance troubles if they built a shed for "it" in the backyard. He had taken Tony home with him this evening to stave off argument. Tony was his lawyer friend, a smart, resourceful chap and a nice fellow, though diplomatic to the backbone.

It did not work out as calculated. There is a tide in the affairs of women when a barrier does not stop them, but only invites them to leap. Chauffeuse-to-be appealed direct to Tony. But Tony was prepared and did not need to glance from one to the other. "Yes, it would be nice, of course. What car had you thought of buying?" He said it with the grace that comes so much easier to the proxy than to the principal. Tom looked doubtful. Was Tony going back on him?

"Well, if you have not really made up your minds yet, I should advise you to take an automobile paper for a while," Tony resumed after explanations. "I have a friend who tells me that it is astonishing how much real information seeps out between the lines of one of those papers when you read it regularly for three or four months. They simply cannot hold it back, much as they try." Tom saw the light. Here was at least delay. But after that, what? It might come out worse than ever. She might get the impression that nothing less than a $2,000 car would be worth while.

"Ha, ha, ha, I had you scared, Tom. Don't deny it." Tom was following his friend to the street car line, and they had just turned the corner safely. "What, you old stylite, where have you been these years? Don't you know how that paper game works? They are just for men. There is not a woman who can read one of them without getting disgusted and all mixed up. All you have to do now, Tom, is to get your wife to read it regularly, bless her innocent soul. But look out for yourself, it is apt to work the other way around with you." "I guess you meant all right, Tony," Tom said briefly, "and I suppose I shall have to chance it, but——well, good night, Tony."

The Motor Car Not an Extravagance—It is argued that many people cannot afford to own motor cars. The answer to this argument is that the ownership of a motor car so increases the radius of the owner's activity, and has such a pronounced influence on his efficiency and health, that he is able to earn an income that will enable him to support a motor car. Of course, there are exceptions to prove this rule, just as there are exceptions in all other lines. It can be admitted, without prejudice to the industry, that some persons may have purchased motor cars at a cost and of a type not adapted to their requirements. This does not prove that this class of persons cannot afford to own motor cars. It must not be assumed that just because it is a motor car, that it is an unnecessary expense or extravagance. The use of the motor car does not distract its owner's attention from his business. On the contrary, its use enables him to do more business, with less effort, in the same hours, by shortening the time of his errands and business calls. At the same time it affords opportunity for healthful recreation for himself and family and saves many expenses which were common before its use began.—C. C. Hanch, Treasurer of the Nordyke & Marmon Company.

Award of Trophies in Brooklyn Dealers' Run

A. R. Pardington, referee in the recent two-day reliability contest of the Brooklyn Motor Vehicle Dealers' Association on Long Island, has announced the winners of the eight handsome trophies contested for in the two sections of the contest as follows:

Martin-Evans trophy, division 1A, cars that sell for $800 and under, won by No. 14 Hupmobile, driven by D. M. Bellman.

Brooklyn *Daily Times* trophy, division 2A, cars that sell for $801 to $1,200, won by No. 4 Hudson, driven by W. H. A. Bruns.

Standard Union trophy, division 3A, cars that sell for $1,201 to $1,600, won by No. 26 Crawford, driven by W. J. Houldcroft.

The Julius Bindrim prize, offered as a second trophy in division 3A, was won by No. 8 Maxwell, driven by E. T. Bloxam.

The Kingsley Swan trophy, divisions 4A, 5A, 6A and 7A, for touring cars that sell for $1,601 and over, won by No. 21 Columbia, driven by G. M. Wagner.

The Brooklyn *Life* trophy, competed for in divisions 4A, 5A, 6A and 7A, open for runabouts that sell for $1,601 and over, won by I. C. Kirkman, who drove No. 1 Columbia car.

In the tourist section the most consistent running time was made by the Ford, No. 50, to which is awarded the Brooklyn *Daily Eagle* trophy.

The next best running time in the tourist division was made by No. 52 Cadillac, driven by H. G. Woodworth, who wins the Long Island Automobile Club trophy.

Auto Mail Delivery Efficiency Test

PHILADELPHIA, Aug. 22—The first United States mail automobile efficiency trial, to be held under the auspices of the Quaker City Motor Club, will take place during the week of August 29 to September 3. Each day two cars will start from a point selected by the post office authorities, the object being to reduce the time of delivering the early morning mail. The time en route is to be strictly noted and the car finishing delivery in the quickest time will be awarded a sterling silver trophy. So far the following entries have been received:

Louis J. Bergdoll Motor Car Company, Bergdoll, August 29; Oxford Automobile Company, Brush car, August 29; Philadelphia K. M. F. Company, Hudson car, August 30; Olds-Oakland Company, Oakland, August 30; W. J. Sprankle, Overland, August 31; Harvey Ringler, Chalmers-Detroit, August 31; H. C. K. Motor Car Company, Kline-Kar, September 1; Longstreth Motor Car Company, Pullman, September 1; Prescott-Adamson, Reo, September 2; Continental Motor Car Company, Parry, September 2; Penn Motor Car Company, Mitchell, September 3; Johnson Motor Car Company, Al La Roche, September 3.

Catskill Reliability Run and Hill Climb

Entry blanks are out for the two-day Catskill Reliability Contest and Hill Climb September 10 and 12. The tour will start from New York on Saturday morning, September 10, at 7:30 o'clock, but the cars will not check out until assembled in line at Edgewater, N. J. The tourists will rest on Sunday in the Catskills and on Monday the hill climb will take place on Kaaterskill Clove. A fine program has been arranged for the hill climb. The classification will be by price and piston displacement in cubic inches. The events are as follows:

No. 1—Gasoline stock cars, $800 or under.
No. 2—Gasoline stock cars, $801 to $1,200.
No. 3—Gasoline stock cars, $1,201 to $1,600.
No. 4—Gasoline stock cars, $1,601 to $2,000.
No. 5—Gasoline stock cars, $2,001 to $3,000.
No. 6—Gasoline stock cars, $3,001 to $4,000.
No. 7—Gasoline stock cars, $4,001 and over.
No. 8—Open to amateurs. Limited to cars owned by residents of Catskill and a radius of fifteen miles from Kaaterskill Clove Mountain. Handicap according to price.
No. 9—Gasoline stock chassis between 161 to 300 cubic inches piston displacement.
No. 10—Gasoline stock chassis between 301 to 450 cubic inches piston displacement.
No. 11—Gasoline stock chassis between 451 to 500 cubic inches piston displacement.

Society of Automobile Engineers Growing Rapidly

The following members and associates of the Society of Automobile Engineers were elected this week: Frederick W. Blanchard, Faulkner-Blanchard Motor Car Co., Detroit, Michigan; Henry L. Barton, Metal Products Company, Detroit, Michigan; Edward W. Curtis, Jr., Studebaker Bros. Mfg. Company, Chicago, Ill.; DeWitt Clinton Cookingham, Rauch & Lang Company, Cleveland, Ohio; Geo. W. Cooke, Pierce-Arrow Motor Car Company, Buffalo, New York; T. P. Chase, Chalmers Motor Company, Detroit, Michigan; Wm. Morris Davis, E. R. Thomas Motor Company, Buffalo, New York; Edward Dixon, Thos. B. Jeffery & Co., Kenosha, Wisconsin; Frank E. Ferris, Brush Runabout Company, Detroit, Michigan; H. W. Gillett, Aluminum Castings Company, Detroit, Michigan; Starling Henry Humphrey, Brush Runabout Company, Detroit, Michigan; Geo. N. Hickey, Van Dyke Motor Car Company, Detroit, Michigan; Wm. H. Hogle, Brush Runabout Company, Detroit, Michigan; Harold H. Kennedy, The Waverley Company, Indianapolis, Indiana; Fritz Loeffler, Mannheim, Waldorf, Germany; Ralph L. Morgan, Ralph L. Morgan Company, Worcester, Mass.; Horace Henley Newson, McCord Manufacturing Company, Detroit, Michigan; George L. Norris, American Vanadium Company, Pittsburg, Pa.; Chas. B. Rose, Velie Motor Vehicle Company, Moline, Ill.; Wm. H. Reddig, Chalmers Motor Company, Detroit, Michigan; Charles R. Short, G. & E. Power Company, Philadelphia, Pa.; Nicholas Shamroy, Landau & Golden Company, New York City; Clyde W. Stringer, Brush Runabout Company, Detroit, Michigan; Geo. A. Weidely, Premier Motor Mfg. Company, Indianapolis, Indiana; Frank E. Couch, 316 Hudson Street, New York City; Charles F. Case, Oliver Motor Car Company, Detroit, Michigan; Clyde E. Dickey, Denman & Davis, New York City; Wellington F. Evans, Metal Products Company, Detroit, Michigan; Henry May, Pierce-Arrow Motor Car Company, Buffalo, New York; George S. Morrow, Stepney Spare Wheel Company, Chicago, Ill.; Albert F. Rockwell, New Departure Mfg. Company, Bristol, Conn.; Winfield DeWitt Rheutan, The White Company, Cleveland, Ohio; R. A. Radle, Clark Sales Company, Detroit, Michigan; Thomas Towne, Ideal Opening Die Company, New York City; Walter Webster Totman, Whitney Mfg. Company, Hartford, Conn.

Westerners Contemplating Secession from A. A. A.

SEATTLE, WASH., Aug. 22—Convinced that the West, and particularly the Pacific Coast, will never derive any benefit from either the A. A. A. or the A. C. A., Frank M. Fretwell, a prominent member of the Automobile Club of Seattle, and Clifford Harrison, assistant secretary of the Portland Automobile Club, have issued a call for a meeting to be held in Seattle, September 4th, to discuss plans for the formation of a Western Automobile Association. The plan embraces every club in Washington, Oregon, California and British Columbia.

At that time the Portland, Ore., and Vancouver, B. C., clubs will attend in a body as guests of the Seattle Automobile Club. The delegates attending the meeting will be asked to bring a certified statement of the membership of the club they represent, as the voting will be on the basis of the club membership.

It is also Harrison's idea to publish a substantial periodical in connection with the association and to make the annual dues large enough to cover the cost of sending copies to each member, the book to be similar to the one published by the A. A. A.

George S. Patterson to Be President

Having resigned his position as general manager of the Gaeth Automobile Company, of Cleveland, Ohio, George S. Patterson is now in the East on a mission of more than the usual importance. It is whispered about that he is to be the president of one of the important companies and that he is on a "still hunt" for men and material with which to put the finishing touches on his already successful career in the automobile field.

Perfect Scores in Munsey

(*Continued from page 297.*)

of Rhode Island and those of Southern Connecticut. They remained in practically the same condition as he left them until within the past ten years, when the coming of the automobile gave road building a decided impetus.

From New London to Westerly there could be considerable improvement, but from that point to Narragansett Pier and from the Pier for 25 miles toward Providence, the roads leave nothing to be desired. The route to Boston was over the chief line of communication between the earliest colonies in New England. Governor Winthrop laid out most of the roads, and traces of ancient earthworks erected by him to protect the road during Indian troubles are still visible.

Historically the roads were interesting. Leaving the Thames, the way led past the school house in which Captain Nathan Hale taught when he received the call to arms that meant shameful death and immortal fame for him. Fort Griswold, that ill-fated stronghold that was overwhelmed by a British force, next attracted attention. The story of Colonel Ledyard's foul murder and the massacre of the handful of defenders of the fort were remembered while the cars whirled by.

The end of the day's run at Boston, with all the thrilling memories of that city, was an enthusiastic finale to a day of mixed feelings. The city of Providence was generally censured for the position assumed by the authorities against the tourists and not a voice was raised in behalf of the action.

One of the features of the night stop at New London was an informal reception at the exclusive Thames Club, at which Mr. Doolittle, of the editorial staff of THE AUTOMOBILE, was a guest of honor. After being presented to all present Mr. Doolittle was asked to speak, and in a somewhat detailed address he treated of the mission of the motor, particularly applied to conditions in the State of Connecticut, pointing out the vast increase in real estate valuation that has resulted by reason of the effect of the automobile in making great tracts of barren land valuable for the bungalow sites of rich men living in New York and other centres of business. He also outlined the purpose of the Munsey Historic Tour.

Fourth Day

PORTLAND, ME., Aug. 19—In a driving rainstorm the Munsey tourists started the fourth day of the run from in front of the Hotel Lenox. Boston is a difficult place to get out of, and several of the cars managed to get lost before reaching the city limits. The first few miles were through territory rich in historic incident. The place from which Paul Revere started his famous ride; the scene of the glorious defeat of Bunker Hill and a dozen other events treasured in the history of the nation, were passed in getting started on the great Atlantic Boulevard leading to Portland. This road was built early in the last century as an outlet for the rum and sugar manufactured at the Maine metropolis from the cane syrup and molasses imported in the holds of the numerous ships that plied between that port and the West Indies. Naturally there was other freight to be moved over it, as the country developed, and at one time the travel from Boston, and even farther south and west, was comparatively heavy. But in the interim that followed the decay of the rum and sugar trade, and before the fish industry of this section became a commanding factor, the road fell into disuse to a large extent and only within the last few years has it been rehabilitated. In places it is about as fine as anything so far traversed by the tourists, but in others the work of straightening, smoothing and hardening is still in the early progressive stage.

Maine is taking a vast interest in State roads, and in no fewer than four spots of to-day's route the caravan passed road-making gangs. In New Hampshire the highways were in uniformly good condition. One of the pleasant things about the run through Massachusetts was the hearty reception accorded the travelers at Gloucester, Mass., the ancient seaport, whose ships once sailed on each of the seven seas. Gloucester is not resting on the memory of a glorious past. It is a lively little place and its citizens realize the commercial importance of the automobile even better than several of the avowed centers of motoring. When the tour passed through to-day, the Board of Trade of Gloucester was on hand with a welcome that prejudiced every member of the touring column in favor of the city. Interesting booklets descriptive of the city, its past, present and possible future, were given to everybody in the procession with a hearty expression of good-will toward the automobile.

Beverly, the summer home of President Taft, was another object of curiosity to the caravan.

In Maine the route followed the coast practically all the way to this city, and at the numerous summer resorts big crowds of pretty girls cheered the progress of the tour. No conflict with the authorities was reported to-day, which was a welcome change from the Rhode Island experience.

The Staver-Chicago, No. 23, was the only car that lost its chance to secure a perfect score as a result of the day's run. This car damaged a bearing in the differential on Wednesday, but was not so seriously hurt as to be put out of the running on account of that mishap. But when the car had proceeded two and a half hours out of Boston one of the rear springs gave way and it required 2 hours and 27 minutes of repair work before the car could move on. This caused the Staver-Chicago to be 42 minutes late at noon control and the total penalty assessed by the technical committee was 169 points.

The Inter-State also earned some additional penalties, as some more loose metal, including a bit of phosphor bronze, turned up in the gear case. Mr. Dill decided to accept the penalization now, rather than to wait until later in the run, when he might get much more, and after a thorough examination of the transmission, which occupied 62 minutes, he announced that the car was again in good shape. The penalty imposed to-day was 62 points, making the total against the Inter-State 111.

The score stands at the end of the day with 21 cars still in the list of perfect records.

Fifth Day

BETHLEHEM, N. H., Aug. 20—Across the State of Maine and half way through New Hampshire was the course of the fifth day's running of the Munsey Tour. The roads were smooth enough practically all the way, but the grades and turns proved too much for several of the cars and accomplished the complete downfall of one of them.

It was the Maxwell runabout that succumbed just after passing through Crawford's Notch and with nothing like a real obstacle between the car and the night control. The camshaft broke on the exhaust side, stripping the gears and messing up the mechanism of the car so that it was withdrawn from competition, the penalty assessed being 1,000 points.

The Elmore, privately owned, also met with its first set-back during the day. A broken terminal in the ignition required three minutes' work to fix, and the motor was stopped during that time. The net result was 6 demerits.

The Staver-Chicago suffered further penalty when the upper half of the left rear spring gave way. The penalty was fixed at 73 points.

The Moon car also added a single point to its score, when the jarring and swinging necessary to make 20 miles an hour rendered one minute's repair work necessary on the rear fender. This gives the Moon a total of 2 points.

One of the Fords is in trouble with a loose motor base. The Columbia and Pierce-Racine still have clean scores, despite loose connecting rods in one and ignition trouble in the other.

The wounded Maxwell car was towed away to the Mount Washington garage by the Brush Runabout, used as the photographer's car. All the cars not specially mentioned are apparently in as good condition as when they started.

The Thomas Press car that met with mishap near West Point last Tuesday was repaired by driver George Miller and was rushed over the course to join the caravan at Boston. This the Thomas was able to do, and has been in a prominent position in the line ever since.

The tour proved to be particularly popular in Maine, and clear to the Western boundary, wherever there was a hamlet, crowds gathered to cheer the procession.

The course in New Hampshire, through the heart of the Bretton Woods and the White Mountains, was by far the most picturesque of any so far. The level of the highway rises constantly from the State boundary until the course lies between solemn-looking cliffs, clad in summer verdure and rising precipitously from the road, which is fully 2,000 feet above the level of Casco Bay at its highest point. The way passes through what is called Crowford's Notch, a gash in the mountain, which has been cut down materially so as to make a passable wagon trail.

From the Notch to Bethlehem the roads were excellent, and the 27 cars left in the contest had no difficulty in reaching control within the time limit.

When the city of Portland was the main seaport for this part of the United States and a large part of Quebec, the traffic toward the seaboard and back again was conducted over the old international highway. Long before that road occupied its present direction and position it was one of the most heavily-used highways in this part of the country. When it was first laid out to Quebec from Portland it made a wide detour, skirting the southern foothills of the White Mountains. As far back as 1772 a hunter, Thomas Nash by name, discovered a pass through the mountains that he reported as available to shorten the road distance to Canada. The story, as told to-day, is that Nash, while out hunting near Mount Washington, then an unnamed peak in the wilderness, lost his bearings, and in trying to discover some peak that was known to him, he climbed a tree, and in that elevated position saw that there existed a narrow gorge between two of the giant hills.

The outbreak of the war for independence caused Nash to forget his discovery for the time being, but after peace had been restored he made a formal presentation of the facts to the State government and received an offer of a large land grant if he could demonstrate the feasibility of the route by leading a horse through the Notch. In 1803 Nash made the attempt and succeeded in getting through. Just how much land was given him as a result of his boldness is debatable, but descendants of the Nash family in the vicinity are accounted among the most prosperous of the local citizenship.

The result of finding the pass in the hills was to cut off at least 100 miles from the former route, and inasmuch as it facilitated trade, it was recognized as a good work even in that early day. To-day the road that follows the course laid out by the hunter is as nearly a perfect specimen of what a mountain road should be as can be imagined.

While the inland wagon trade of Portland has dwindled to nothing and the road is no longer used to bring in freight to be shipped in American vessels, it is of wide importance. For local traffic it is remarkably adequate, and as an automobile highway it answers its purpose admirably.

Sixth Day

Burlington, Vt., Aug. 22—The State of Vermont appreciates the automobile. From one side of Vermont to the other, the heartiest greetings of the tour were extended to the Munsey tourists to-day. No cross-roads were too significant and no city too large to welcome the travelers and the route of the sixth day of the tour, from Bethlehem to the shores of Lake Champlain, was the scene of a continuous ovation.

Vermont is well justified in her favorable position toward the motor car for to that expression of development the whole transverse road system of the State is undoubtedly due.

It was automobile day at Montpelier and the capital was decked out in bunting when the head of the caravan pushed itself over the last hill and entered the city. The business houses closed at noon in honor of the tour and the Automobile Club of Vermont, one of the most active State organizations of its size in the country, arranged for its annual parade through the streets of the capital to take place while the Munseyites were in midday control.

At Montpelier the tour was welcomed by the Governor and other dignitaries and the Automobile Club of Vermont held open house in half a dozen places. After the parade of local automobiles, the run of the afternoon to Burlington was commenced and night control was reached at about 4 o'clock.

The first real mixup of the tour occurred at Burlington. The day's run for Tuesday had been scheduled at 202 miles, but it was found that the time required to ferry over all the cars to Chazy, at the northern end of Lake Champlain, would require over six hours and that boats were not available to do the work at night. Therefore, Referee Ferguson decided to have the cars ferried to Plattsburg and to start the run from that place, making the road distance 137 miles for the day. After preliminary arrangements had been made to do this it was found that only fifteen cars could cross during the night and these were ferried over, the rest being obliged to wait until morning.

Great Western car No. 18 was badly wrecked this afternoon not far from Burlington. The cause of the accident was a careless pedestrian, a woman who stood idly in the path of the car and made no effort to escape, forcing the driver to swing out suddenly. The place was just at the entrance to a covered bridge and there was not sufficient room for the car to pass. It struck the abutment of the bridge and wrapped its front wheels and axle about the timbers. Washington car No. 5 also had some hard luck.

Five miles out of Bethlehem, it was discovered that the radiator was dry and water had to be taken on. Mr. Carter explained to the referee that the car had been filled up in control but that probably some mischievous or careless person had turned the cock and let the water escape. As the car did not leak after being filled, this view of the case was officially accepted and no penalty was imposed.

The Crawford, No. 27, lost its perfect score when it burned out a main bearing on its shaft somewhere east of Montpelier and was late at noon control by 435 minutes. For the resulting trouble to transmission and rear axle, a technical penalty of 432 points was also given. The car was able to join the procession again, and is apparently working smoothly.

The Ford 30 was given eight demerits for work on a loose strut rod bracket, thus taking the car out of the clean score class.

The wrecked Great Western was drawn to a nearby blacksmith shop and the smith labored over it until late in the night. He practically made a new wheel, straightened the bent axle and it was reported that the car would check out to-morrow.

Seventh Day

Saratoga, Aug. 23—The route to-day was materially shortened by shipping the cars across the lake to Plattsburg and starting the run from Bluff Point instead of going clear up to Chazy. It was found that to follow the originally planned route would require ferrying the cars a longer distance in smaller steamers and that it would take at least six hours to do so. Therefore, part of the cars were shipped across the Lake last night and the remainder this morning. The start was made at 11 o'clock, and the run through the Adirondacks, touching Elizabethtown and finishing at Saratoga, was uneventful. The Glide car came to grief during the morning run. This car reported by telegraph that it would withdraw on account of trouble with a main bearing, and loosened connecting rods.

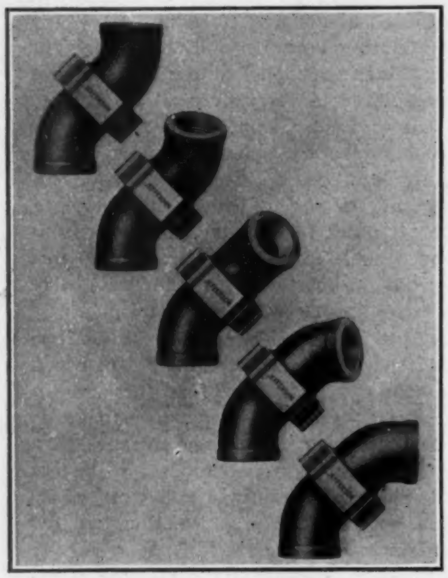
The Elmore is also out of commission because of the failure of the factory to file a stock-car certificate. The entry of the car was made subject to such action by the manufacturers. It is continuing as a non-contestant.

The penalty on the Great Western has not yet been fixed.

Prominent Automobile Accessories

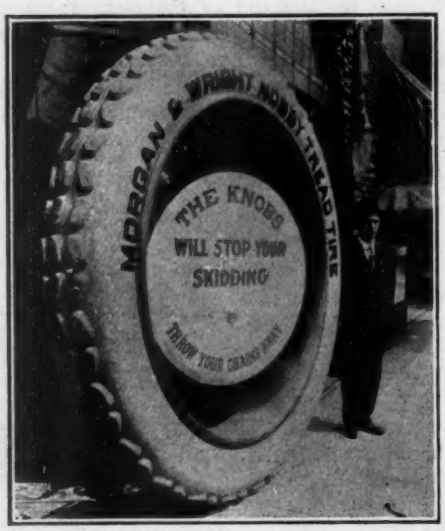
A NEW SWING PIPE UNION

In the accompanying illustration is shown the new swing union which is being made by the Jefferson Union Co.,



Showing Jefferson Swing Union in various positions

of Lexington, Mass. It consists of two 45° elbow parts with a spherical iron-to-iron seat ground to a perfect fit, the two ends being connected by a nut of either brass or malleable iron. At slightly additional cost these unions can be made with the company's regular brass-to-iron seat, which consists of a narrow brass ring of wrought metal sunk in a channel in which it fits tightly. A lip of iron pro-



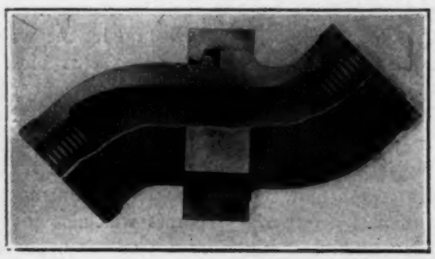
The largest tire in the world

tects the brass ring from contact with the fluid, and also from injury, should the pipe be screwed in too far. For close work this union can be equipped with a special notched nut which can be set up with a bar of iron and a hammer.

One of the pictures shows the union in various positions from that in which it will connect parallel pipes slightly offset to the other extreme of connecting two pipes in the same plane at 90°. In the intermediate positions it is possible to make connections between pipes at a great variety of angles, the joint always being perfectly tight regardless of the angle of connection due to the perfectly ground spherical seat. By using the combination of one end of the swing union in connection with regular parts, it is applicable to so many kinds of odd connections that it may almost be considered a universal union.

SPEEDOMETER AT LEFT SIDE OF DASH

It has been demonstrated that the left side of the dash is a good place for the speedometer, and the Packard Motor Car Company has arranged to attach them on that side of its 1911 models if desired. The accompanying illustration shows the speedometer in that position, which permits of an easy reading of the instru-



Sectional view of Jefferson Swing Union

ment by both the driver and the occupant of the left front seat. When the speedometer is on the right side the passenger on the left seat cannot see it at all, and often it is difficult for the driver to see through the spokes of the steering wheel when driving at speed.

The left side position also saves the driver from answering the questions of the curious and the nervous. Any speedometer may be attached in this position, because the different speedometer manufacturers are prepared to supply instruments driven from the left front wheel.

THE LARGEST TIRE IN THE WORLD

There is shown herewith an exact reproduction of the famous Morgan & Wright Nobby Tread Tire, which was used for display purposes during the recent Elks' convention at Detroit. According to standard tire sizes, it would be a 96 x 12-inch tire. It is so large that a man can stand upright comfortably inside the rim.

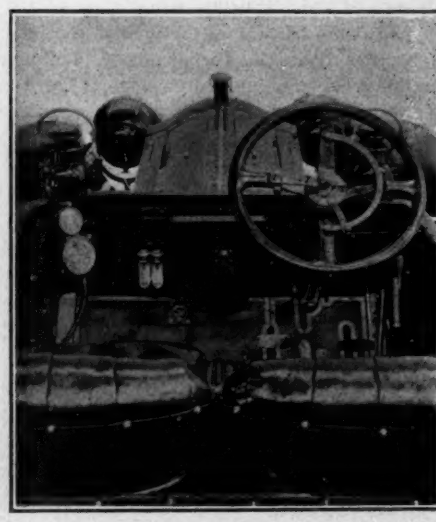
SPECIAL TIRES FOR AEROPLANES

The Diamond Rubber Company, of Akron, O., is in the market with a special aeroplane tire. The tire shown

Leather-tread tire for aeroplanes

here with a tread of chrome leather has aroused considerable interest among aviators.

Most types of aeroplanes use from two to four rubber-tired wheels for running along the ground in starting and also for stopping. In the latter case a spoon brake like the old bicycle type, braking directly on the tire itself, is used. On all rubber tires the action of the brake is somewhat destructive to the



Speedometer at left side of dash

tread. It is for the purpose of obviating the wear of the spoon brake that this aeroplane tire is made with the tread of chrome leather. It is of the single tube type.